CS217-59 file

DEPARTMENT OF COMMERCE
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
OFFICE OF STANDARDS SERVICES

COMMERCIAL STANDARD CS217-59

GRADING OF ABRASIVE GRAIN ON COATED ABRASIVE PRODUCTS

Commercial Standard CS217-59, Grading of Abrasive Grain on Coated Abrasive Products (superseded by Product Standard PS8-67). PS8-67 was withdrawn by the Department of Commerce on July 25, 1977.

This product standard was replaced by the American National Standards Institute (ANSI) Standard B74.18, Specification for Grading of Certain Abrasive Grain on Coated Abrasive Products.

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COMMERCIAL STANDARD CS217-59

Grading of Abrasive Grain on Coated Abrasive Products

A recorded voluntary standard of the trade published by the U.S. Department of Commerce

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U.S. DEPARTMENT OF COMMERCE
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OFFICE OF TECHNICAL SERVICES

COMMODITY STANDARDS DIVISION

With the cooperation of

National Bureau of Standards

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The initial printing of this Commercial Standard was made possible through the cooperation of the Coated Abrasives Manufacturers' Institute in procuring copies in advance for its members.

Grading of Abrasive Grain on Coated Abrasive Products

[Effective March 18, 1959]

1. PURPOSE

1.1 The purpose of this Commercial Standard is to provide a nationally recognized standard for the grading of the abrasive grain on coated abrasive products. It provides uniform methods for recovering the grain from the coated product, and for testing the recovered grain to determine conformity with this standard. The standard also serves as a basis for understanding between purchasers and sellers as to the particle size desired or supplied, and provides a uniform method of declaring conformance of the product with the grit size designated.

2. SCOPE

2.1 Although the information contained in this Commercial Standard may be of use in the preparation of abrasive grain for making coated abrasive products, the scope of this Commercial Standard is confined to a determination of the grading or grain size of the abrasive grain on the coated product. It has been developed to cover, insofar as possible, the grading of the coated abrasive products listed in Simplified Practice Recommendation R89. [1] However, in the case of certain coated abrasive products, grading practices vary from one manufacturer to another and consideration of the information given herein under "Exceptions" (see par. 3.1.2) is necessary for the correct interpretation of this Commercial Standard.

3. CLASSIFICATION, CONTROL, AND DEFINITIONS

3.1 CLASSIFICATION.—Coated abrasive grain sizes fall into two general classifications, screen grades and sedimentation grades. Those which are coarse enough to be measured and controlled by the use of sieves are called screen grades, whereas those which are so fine that they have to be measured and controlled by a sedimentation method based on Stokes Law are called sedimentation grades. The term "screen grade" is used because of well established industry practice, but the particle size distribution is actually controlled by means of sieves.

3.1.1 *Kinds of abrasive grain and grit sizes.*—The various kinds

[1] Copies of Simplified Practice Recommendation R89-55, or latest issue, Coated Abrasive Products, may be obtained from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. The 1955 issue is 10¢.

of abrasive grain or minerals and the grit sizes for each grade covered by this Commercial Standard are as follows:

Screen grades

Mineral	Grit size
Aluminum Oxide, Silicon Carbide and Garnet	6/0–220 and coarser
Emery	Fine through Extra Coarse
Flint (finishing paper)	4/0, 3/0, and 2/0
Flint (paper)	Extra Fine through Extra Coarse
Sedimentation grades	
Aluminum Oxide, Silicon Carbide and Garnet	7/0–240 and finer
Flint (finishing paper)	7/0, 6/0 and 5/0

3.1.2 *Exceptions.*

3.1.2.1 *Flint Tannery Paper Rolls, E Backing (Flint Snuffing Paper).*—Flint Tannery grades do not necessarily correspond to any other Flint grade. They vary from one manufacturer to another and until more clearly defined and simplified, they cannot be included in the present Commercial Standard.

3.1.2.2 *Flint Pouncing Paper Sheets, D Backing.*—Flint Pouncing Paper grades, although designated by grit numbers or symbols such as 10/0 through 1/2, do not necessarily correspond to any other Flint grades. Until more clearly defined and simplified, they cannot be included in the present Commercial Standard.

3.1.2.3 *Emery Polishing Paper.*—Emery Polishing Paper, which is sometimes called French Emery Paper, is not graded according to the standards shown for Emery, and should not be confused with Emery Paper Sheets, C Backing, as listed in R89.

3.1.2.4 *Crocus Cloth.*—Crocus Cloth is a coated abrasive product which has an abrasive grain coating consisting essentially of ferric oxide. Abrasive grain size shall be as specified in Federal Specification P–C–458 [2] which is as follows:

All through----------U.S. Std. Sieve #140
Not more than 20% on----------U.S. Std. Sieve #325

3.2 CONTROL.—The basis for the control of screen grades consists of a series of "standard sands". The basis for the control of sedimentation grades consists of a set of "standard particle size accumulation curves" and "standard checking minerals." The standard sands for screen grades of waterproof and nonwaterproof coated abrasives are identical, but the standard particle size accumulation curves for certain sedimentation grades of waterproof differ from those for corresponding grades of nonwaterproof coated abrasives.

3.3 DEFINITIONS.

Control.—That portion of the grain which passes through the control sieve but remains on the fines sieve.

[2] A copy of Federal Specification P–C–458, Cloth, Abrasive, Crocus, may be obtained from the Business Service Center, General Services Administration, Regional Office Building, 7th and D Sts., SW., Washington 25, D.C. The current issue is priced at 5¢.

Fines.—That portion of the grain which passes through the fines sieve.

Glue-bond.—Coated abrasive products made with animal hide glue. Adhesive completely water soluble.

Modified glue-bond.—Coated abrasive products made with animal hide glue containing a mineral filler. Adhesive completely soluble, but mineral filler insoluble in water.

Overgrade.—That portion of the grain which remains on the control sieve.

Resin over Glue-bond.—Coated abrasive products wherein the making coat is a type of adhesive which is water soluble or is softened in water, and the sizing coat is a resin which is insoluble in readily available solvents. Either or both adhesive coats may or may not contain mineral filler.

Resin over Resin-bond.—Coated abrasive products wherein the making and sizing adhesive coats are insoluble in readily available solvents and may or may not contain mineral fillers.

Total Grade, coarseness of.—That portion of the grain which passes through the coarse sieves consisting substantially of the entire sample.

Waterproof.—Coated abrasive products made on waterproof type backings with resin or varnishes which are insoluble in water. They fall into two classifications. Those having adhesives which are soluble in readily available solvents, and those having adhesives which are not soluble in readily available solvents.

4. STANDARD GRADING LIMITS

4.1 Screen Grades.—The grading of a mineral classified as a screen grade abrasive shall always be considered with reference to the grading of its standard sand as determined by testing both grain and standard sand with the same sieves [3] according to the procedures described herein. The abrasive grain shall be recovered from the coated sheet as described in Section 5. The recovered grain shall meet the following grading limits.

4.1.1 Aluminum Oxide, Silicon Carbide and Garnet.

4.1.1.1 *Total Grade, coarseness of.*—The total grade of the grain shall be of such grain size distribution that it will satisfy the requirements contained in table 1.

4.1.1.2 *Overgrade.*—The overgrade percentage by weight for each grit size is determined with the control sieve. The percentage of grit retained on the sieve shall not exceed six-fifths of that shown by the standard sand. The control sieve for each grit size and the overgrade limits to be met by it, when tested by use of the standard sand for that grit size in order to determine its suitability for use as a standard testing sieve, are listed in table 5.

4.1.1.3 *Fines.*—The fines percentage by weight for each grit size is determined with the fines sieve. The percentage of grit passing through the fines sieve shall not differ by more than plus 10 or minus 7 from that shown by the standard sand. The fines sieve for each grit size and the fines limits to be met by it, when tested by use of the standard sand for that grit size in order to determine its suitability for use as a standard testing sieve, are listed in table 5.

[3] For detailed information on sieves see par. 6.1.2.

TABLE 1.—*Aluminum, Silicon Carbide and Garnet*

Grit size	Coarseness of total grade	
	Sieve through which substantially 100% (all but a trace) shall pass	Sieve through which at least 99.5% shall pass
6/0–220	13 XX	15 XX
5/0–180	11 X	13 XX
4/0–150	9 Std.	11 X
3/0–120	6 Std.	9 Std.
2/0–100	3 Std.	6 Std.
0–80	1 Std.	3 Std.
½–60	38 GG	1 Std.
1–50	32 GG	38 GG
1½–40	28 GG	32 GG
2–36	24 GG	28 GG
2½–30	20 XXXGG	24 GG
3–24	14 U.S. Std.	20 XXXGG
3½–20	10 U.S. Std.	14 U.S. Std.
4–16	8 U.S. Std.	10 U.S. Std.
4½–12	6 U.S. Std.	8 U.S. Std.

4.1.2 *Emery and Flint.*

4.1.2.1 *Total Grade, coarseness of.*—The total grade of the grain shall be of such grain size distribution that it shall satisfy the requirements contained in table 2.

4.1.2.2 *Overgrade.*—The overgrade percentage by weight for each grit size is determined with the control sieve. The percentage of grit retained on the control sieve shall not exceed 5% when the standard sand shows less than 3% overgrade, and shall not exceed twice that shown by the standard sand when the standard sand shows 3% or more overgrade. The control sieve for each grit size and the overgrade limits to be met by it, when tested by use of the standard sand for that grit size in order to determine its suitability for use as a standard testing sieve, are listed in table 6.

4.1.2.3 *Fines.*—The fines percentage by weight for each grit size is determined with the fines sieve. The percentage of grit passing through the fines sieve shall not differ by more than plus 15 or minus 10 from that shown by the standard sand. The fines sieve for each grit size and the fines limits to be met by it, when tested by use of the standard sand for that grit size in order to determine its suitability for use as a standard testing sieve, are listed in table 6.

4.2 SEDIMENTATION GRADES.—The abrasive grain, as recovered from the coated sheet and tested in accordance with the recovery and grading procedure described herein, shall be of such grain size that its accumulation curve shall meet the following requirements.

4.2.1 *Aluminum Oxide and Silicon Carbide—waterproof.*—The accumulation curve of any grit size shall not show a particle size in excess of that shown in figure 1 by the maximum standard curve, nor less than that shown by the minimum curve for each grit size at any H% (height percent) point between 3% and 50%.[4]

[4] For detailed information on height-percent see table 3.

TABLE 2.—*Emery and flint*

Abrasive grain	Grit size	Coarseness of total grade	
		Sieve through which substantially 100% (all but a trace) shall pass	Sieve through which at least 99.5% shall pass
Emery	Fine	5 Std.	8 X
	Medium	40 GG	5 Std.
	Coarse	28 GG	40 GG
	Extra Coarse	20 XXXGG	24 GG
Flint (finishing paper).	4/0	13 XX	15 XX
	3/0	11 X	13 XX
	2/0	9 Std.	11 X
Flint (paper)	Extra Fine	5 Std.	10 X
	Fine	40 GG	5 Std.
	Medium	28 GG	40 GG
	Coarse	24 GG	28 GG
	Extra Coarse	20 XXXGG	24 GG

4.2.2. *Garnet-waterproof; and Aluminum Oxide, Silicon Carbide and Garnet—other than waterproof.*—The accumulation curve of any grit size shall not show a particle size in excess of that shown in figure 2 by the standard curve for each grit size at any H% point between 3% and 50%.

4.2.3 *Flint Grits 7/0, 6/0 and 5/0.*—The accumulation curves for Flint grits 7/0, 6/0 and 5/0 shall be within plus or minus 2 microns of the grit sizes 320, 280 and 240, respectively, as shown in figure 2, at any H% point between 3% and 50%.

5. ABRASIVE GRAIN RECOVERY PROCEDURE

5.1 SCREEN GRADES.—The abrasive grain recovery procedures described herein insure a free flowing mineral at 50% relative humidity, which is essential for the accurate determination of grading. They shall be followed in recovering abrasive grain from screen grades of coated abrasive products for grading. The screen grades are listed in paragraph 3.1.1.

5.1.1 *Types of bond.*—Different types of bond require different recovery procedures. These bonds are defined in paragraph 3.3.

5.1.2 *Recovery procedure for glue-bond coated abrasives.*—Take a sufficiently large sample to insure recovery after the sampling methods described in paragraph 6.1.3.3, of at least 100 grains (6.5 grams) of abrasive grain for hand sieving, or at least 10 grams of abrasive grain for mechanical sieving. Place the sample in a beaker and cover with hot water. When the glue is entirely softened and most of the mineral has fallen off, wash the sample with a jet of hot water, rubbing the sample gently with the finger tips to make certain that all of the mineral is removed. Follow either Procedure A or B, depending on the grit number and type of abrasive grain of the coated abrasive product.

SEDIMENTATION GRADING

FIGURE 1.—*Standard Curves*

Waterproof Aluminum Oxide and Silicon Carbide

600–9/12/35 400–2/6/36
500–3/18/37 360, 320, 280, 240–9/13/33

Micron Size

H%	240		280		320		360		400		500		600	
%	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.
3	83. 0	79. 5	73. 0	69. 4	62. 5	58. 5	50. 0	46. 5	40. 0	36. 5	34. 6	------	32. 0	------
10	73. 5	70. 8	62. 0	58. 5	52. 0	48. 6	40. 5	37. 5	33. 3	31. 5	28. 0	------	25. 2	------
20	67. 5	64. 4	54. 6	51. 4	45. 3	42. 3	35. 5	33. 0	29. 5	27. 8	24. 5	------	20. 8	------
30	63. 3	60. 0	50. 3	47. 5	41. 4	38. 5	32. 6	30. 3	27. 1	25. 0	22. 2	------	18. 5	------
40	60. 0	56. 5	47. 0	44. 3	38. 4	35. 9	30. 5	28. 5	25. 2	23. 0	20. 7	------	16. 8	------
50	57. 0	53. 5	44. 0	41. 9	36. 0	33. 9	28. 8	26. 8	23. 6	21. 2	19. 7	------	16. 0	------

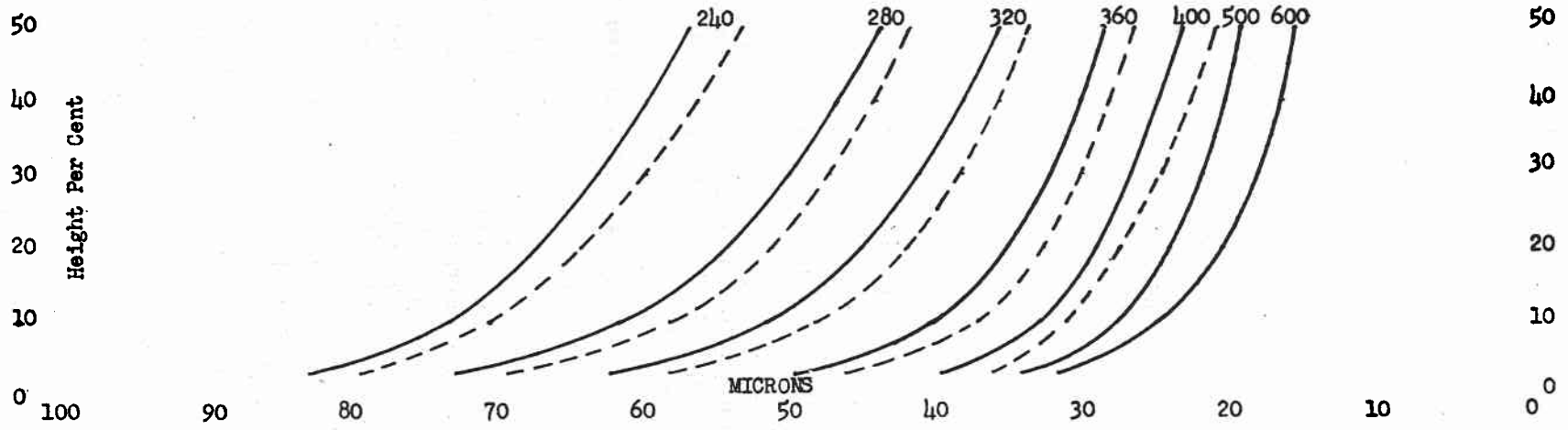

FIGURE 2.—*Standard Curves*

Garnet—Waterproof

Aluminum Oxide, Silicon Carbide, Garnet and Flint—Other tban Waterproof

8/0, 7/0 Garnet=280, 240 3/17/37
Aluminum Oxide, Silicon Carbide 3/17/37
7/0, 6/0, 5/0 Flint=320, 280, 240 3/17/37

Micron Size

Height %	240	280	320	360	400	500
3	77. 0	64. 5	53. 0	50. 0	40. 0	34. 6
10	66. 8	54. 2	45. 3	40. 5	33. 3	28. 0
20	60. 2	48. 8	41. 0	35. 5	29. 5	24. 5
30	56. 7	45. 3	37. 6	32. 6	27. 1	22. 2
40	53. 8	42. 4	34. 8	30. 5	25. 2	20. 7
50	51. 0	40. 0	32. 7	28. 8	23. 6	19. 7

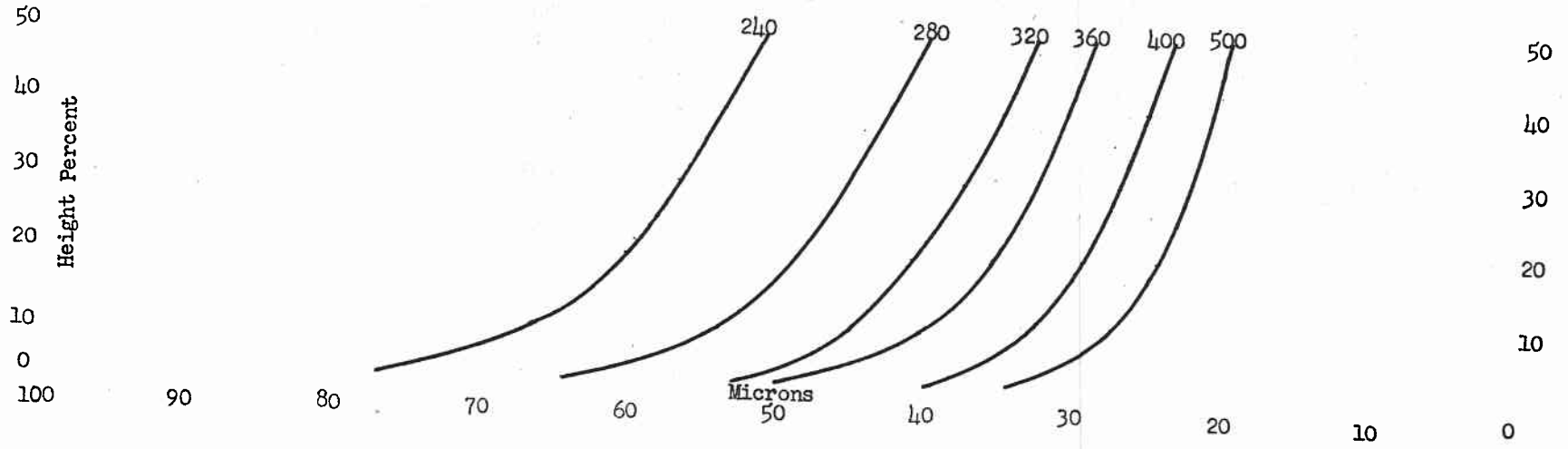

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TABLE 3.—*Height percent*

Points sedimented	Total points sedimented										
	20	20½	21	21½	22	22½	23	23½	24	24½	25
mm.	*H%*	*H%*	*H%*	*H%*	*H%*	*H%*	*H%*	*H%*	*H%*	*H%*	*H%*
1	5.0	4.9	4.8	4.7	4.5	4.4	4.3	4.3	4.2	4.1	4.4
2	10.0	9.8	9.5	9.3	9.1	8.9	8.7	8.5	8.3	8.2	8.0
3	15.0	14.6	14.3	14.0	13.6	13.3	13.0	12.8	12.5	12.3	12.0
4	20.0	19.5	19.0	18.6	18.2	17.8	17.4	17.0	16.7	16.3	16.0
5	25.0	24.4	23.8	23.3	22.7	22.2	21.7	21.3	20.8	20.4	20.0
6	30.0	29.3	28.6	27.9	27.3	26.7	26.1	25.5	25.0	24.5	24.0
7	35.0	24.1	33.3	32.6	31.8	31.1	30.4	29.8	29.2	28.6	28.0
8	40.0	39.0	38.1	37.2	36.4	35.6	34.8	34.0	33.3	32.7	32.0
9	45.0	43.9	42.9	41.9	40.9	40.0	39.1	38.3	37.5	36.7	36.0
10	50.0	48.8	47.6	46.5	45.5	44.4	43.5	42.6	41.7	40.8	40.0
11	55.0	53.7	52.4	51.2	50.0	48.9	47.8	46.8	45.8	44.9	44.0
12	60.0	58.5	57.1	55.8	54.5	53.3	52.2	51.1	50.0	49.0	48.0
13	65.0	63.4	61.9	60.5	59.1	57.8	56.5	55.3	54.2	53.1	52.0
14	70.0	68.3	66.7	65.1	63.6	62.2	60.9	59.6	58.3	57.1	56.0
15	75.0	73.2	71.4	69.8	68.2	66.7	65.2	63.8	62.5	61.2	60.0
16	80.0	78.0	76.2	74.4	72.7	71.1	69.6	68.1	66.7	65.3	64.0
17	85.0	83.0	81.0	79.1	77.3	75.6	73.9	72.3	70.8	69.4	68.0
18	90.0	87.8	85.7	83.7	81.8	80.0	78.3	76.6	75.0	73.5	72.0
19	95.0	92.7	90.5	88.4	86.4	84.4	82.6	80.8	79.2	77.6	76.0
20		97.6	95.2	93.0	90.9	88.9	87.0	85.1	83.3	81.6	80.0
21				97.7	95.5	93.3	91.3	89.4	87.5	85.7	84.0
22						97.8	95 7	93.6	91.7	89.8	88.0
23								97.9	95.8	93.9	92.0
24										98.0	96.0

PROCEDURE A:

For: Grit sizes 6/0–220 through 0–80, Aluminum Oxide, Silicon Carbide and Garnet.
Grit sizes Fine and Medium, Emery.
Grit sizes 4/0, 3/0, 2/0, Flint (finishing paper).
Grit sizes Extra Fine through Medium, Flint (paper).

Decant through a Buchner funnel equipped with a #4 Whatman filter paper or its equivalent of sufficient diameter to extent at least ¼ in. up the sides of the funnel. If the filter clogs from the clay or other filling material present in the backing of cloth-backed products, wash any mineral on the filter back into the beaker and use a new filter paper for the remaining decantations, repeating this procedure if necessary. Wash the mineral with hot water at least 4 times by decantation through the filter.

In the case of *products other than Emery*, wash any mineral on the filter paper back into the beaker with hot water and add an equal amount of c.p. concentrated HCl. Heat to boiling and boil for 7 to 10 minutes, agitating the mineral once or twice during this time. Dilute and decant through a #4 Whatman filter or its equivalent in a Buchner funnel. Wash the mineral with hot water 3 times by decantation through the filter and finally transfer all of the mineral to the filter with hot water. Wash once with alcohol. Dry the mineral and filter paper in an oven at 110° ± 5° C. Brush the mineral lightly from the filter paper into a crucible, leaving the bulk of any clay or other filling material from the backing of cloth backed products on the filter paper. Ignite the mineral over a Bunsen or Meeker burner or in a muffle furnace at 600° ± 20° C for 10 minutes.

In the case of *Emery* do not use acid but continue washing by decantation through the filter until the mineral is completely free from adhesive. Transfer all of the mineral to the filter and proceed directly to the alcohol wash, drying and igniting the mineral as outlined for products other than Emery.

PROCEDURE B:

For: Grit sizes 1/2–60 and coarser, Aluminum Oxide, Silicon Carbide and Garnet.
Grit sizes Coarse and Extra Coarse, Emery.
Grit sizes Coarse and Extra Coarse, Flint (paper).

Filter through a 325 mesh wire sieve and wash the mineral 12 times or more with hot water. Transfer the mineral from the sieve to a #4 Whatman filter paper or its equivalent with hot water. Wash once with alcohol. Dry the mineral and filter paper in an oven at 110° ± 5° C. Brush the mineral lightly from the filter paper into a crucible and ignite over a Bunsen or Meeker burner or in a muffle furnace at 600° ± 20° C for 10 minutes, stirring the mineral once or twice during ignition.

5.1.3 *Recovery procedure for modified glue-bond coated abrasives.*—Use the procedure for glue-bond coated abrasives (see par. 5.1.2). However, in the case of Emery Grit Sizes Fine and Medium, and all coated abrasives having mineral fillers which are insoluble in HCl or too coarse to pass a 325 mesh sieve, separate the mineral filler from the abrasive grain at some point prior to grading. This separation is made by vibratory means with sieves fine enough to retain all of the abrasive grain but coarse enough to pass all of the mineral filler as determined by microscopic examination of both the abrasive grain and the mineral filler, or it is made by any other means that will insure a clean separation of the mineral filler from the abrasive grain with no loss of the abrasive grain.

5.1.4 *Recovery procedure for resin over glue-bond coated abrasives containing no mineral filler in the adhesive coats.*—Take a sufficiently large sample to insure recovery after the sampling method described in paragraph 6.1.3.3, of at least 100 grains (6.5 grams) of abrasive grain for hand sieving, or at least 10 grams of abrasive grain for mechanical sieving. Place the sample in a beaker and cover with hot water. When the adhesive in the making coat has been sufficiently softened, strip the mineral coating from the backing by hand. Rub

the backing gently with the finger tips to remove all traces of mineral. Break the large flakes of coating into relatively small clusters by use of a stirring rod. Follow either Procedure A or B, depending on the grit number and type of abrasive grain.

PROCEDURE A:

For: Grit sizes 6/0–220 through 0–80, Aluminum Oxide, Silicon Carbide and Garnet.
Grit sizes Fine and Medium, Emery.
Grit sizes 4/0, 3/0, 2/0, Flint (finishing paper).
Grit sizes Extra fine through Medium, Flint (paper).

Decant through a Buchner funnel equipped with a #4 Whatman filter paper or its equivalent of sufficient diameter to extend at least ¼ in. up the sides of the funnel. If the filter clogs from the clay or other filling material present in the backing of cloth backed products, wash any abrasive grain and flakes of coating into the beaker and use a new filter paper for the remaining decantations, repeating this procedure if necessary. Wash the mineral with hot water at least 4 times by decantation through the filter.

Transfer all solids to the filter and wash once with alcohol. Dry the solids and filter paper in an oven at 110° ± 5° C. Leaving on the filter paper the bulk of any clay or other filling material from the backing of cloth backed products, brush the remaining solids lightly from the filter paper into a large crucible. Ignite over a Bunsen or Meeker burner or in a muffle furnace at 600° ± 20° C with occasional stirring until substantially all that remains is the mineral with a small amount of ash. At this point the mineral should be fairly free flowing. If this is not the case, it should be further ignited.

Brush the mineral from the crucible into a beaker, add 50% NaOH solution and boil for at least 10 minutes. Dilute with an equal volume of water and decant through a #4 Whatman filter paper or its equivalent in a Buchner funnel. Wash the mineral with hot water at least 4 times by decantation through the filter.

In the case of *products other than Emery*, transfer any mineral on the filter back into the beaker with hot water and add an equal amount of c.p. concentrated HCl. Heat to boiling and boil for 7 to 10 minutes, agitating the mineral once or twice during this time. Dilute and decant through a #4 Whatman filter paper or its equivalent in a Buchner funnel. Wash the mineral with hot water 3 times by decantation through the filter and finally transfer all of the mineral to the filter with hot water. Wash once with alcohol. Dry the mineral and filter paper in an oven at 110° ± 5° C. Brush the mineral from the filter paper into a crucible and ignite over a Bunsen or Meeker burner or in a muffle furnace at 600° ± 20° C for 10 minutes.

In the case of *Emery*, after the NaOH treatment continue washing by decantation through the filter until the mineral is completely free from NaOH. Transfer all of the mineral to the filter and proceed directly to the alcohol wash, drying and igniting the mineral as outlined for products other than Emery.

PROCEDURE B

For: Grit sizes 1/2–60 and coarser, Aluminum Oxide, Silicon Carbide and Garnet.
Grit sizes Coarse and Extra Coarse, Emery.
Grit sizes Coarse and Extra Coarse, Flint (paper).

Decant through a 325 mesh wire sieve and wash the mineral 12 times or more with hot water by decantation through the sieve. Transfer any abrasive grain and flakes of coating remaining on the sieve back into the beaker. Carefully decant this water through the sieve so that no solids are transferred to the sieve and dry the solids in a beaker.

Brush all of the solids into a large crucible. Ignite over a Bunsen or Meeker burner or in a muffle furnace at 600° ± 20° C, with occasional stirring until substantially all that remains is mineral with a small amount of ash. At this point the mineral should be fairly free flowing; if this is not the case, it should be further ignited.

Brush the mineral into a beaker, add 50% NaOH solution and boil for at least 10 minutes. Dilute with an equal volume of water and filter through a 325 mesh sieve. Wash the mineral with hot water at least 4 times. Transfer any mineral from the sieve to a #4 Whatman filter paper or its equivalent with hot water. Wash once with alcohol. Dry the mineral and filter paper in an oven at 110° ± 5° C. Brush the mineral lightly from the filter paper into a crucible. Ignite over a Bunsen or Meeker burner or in a muffle furnace at 600° ± 20° C for 10 minutes, stirring the mineral once or twice during ignition.

5.1.5 *Recovery procedure for resin over glue-bond coated abrasives containing a mineral filler in either or both adhesive coats.*—Use the procedure for resin over glue-bond coated abrasives containing no mineral filler in adhesive coats (see par. 5.1.4). However, in the case of *Emery* grit sizes Fine and Medium, and all coated abrasives having mineral fillers which are insoluble in HCl, or too coarse to pass a 325 mesh sieve, separate the mineral filler from the abrasive grain at some point prior to grading. This separation is made by vibratory means with sieves fine enough to retain all of the abrasive grain, but coarse enough to pass all of the mineral filler as determined by microscopic examination of both the abrasive grain and the mineral filler, or it is made by any other means that will insure a clean separation of the mineral filler from the abrasive grain with no loss of the abrasive grain.

5.1.6 *Recovery procedure for resin over resin-bond coated abrasive containing no mineral filler in the adhesive coats.*—Take a sufficiently large sample to insure recovery after the sampling method described in paragraph 6.1.3.3, of at least 100 grains (6.5 grams) of abrasive grain for hand sieving, or at least 10 grams of abrasive grain for mechanical sieving. Cut the sample over a sheet of glazed paper into approximately one-inch squares. Place the squares and any loose mineral collected on the glazed paper into a large crucible and ignite over a Bunsen or Meeker burner or in a muffle furnace at 600°±20° C stirring occasionally until substantially all that remains is mineral and a small amount of ash. At this point the mineral should be fairly free flowing. If this is not the case, it should be further ignited.

Brush the mineral from the crucible into a beaker, add 50% NaOH solution and boil for at least 10 minutes. Dilute with an equal volume of water. Follow either Procedure A or B depending on the grit number and type of abrasive grain of the coated abrasive product.

PROCEDURE A:

For: Grit sizes 6/0–220 through 0–80, Aluminum Oxide, Silicon Carbide and Garnet
Grit sizes Fine and Medium, Emery
Grit sizes 4/0, 3/0, 2/0, Flint (finishing paper)
Grit sizes Extra Fine through Medium Flint (paper)

Decant through a #4 Whatman filter paper or its equivalent in a Buchner funnel. Wash the mineral with hot water at least 4 times by decantation through the filter.

In the case of *products other than Emery*, transfer any mineral on the filter into a beaker with hot water and add an equal amount of c.p. concentrated HCl. Heat to boiling and boil for 7 to 10 minutes, agitating the mineral once or twice during this time. Dilute and decant through a #4 Whatman filter paper or its equivalent in a Buchner funnel. Wash the mineral with hot water 3 times by decantation through the filter and finally transfer all of the mineral to the filter with hot water. Wash once with alcohol. Dry the mineral and filter paper in an oven at 110°±5°C. Brush the mineral from the filter paper into a crucible and ignite over a Bunsen or Meeker burner or in a muffle furnace at 600°±20°C for 10 minutes

In the case of *Emery*, after the NaOH treatment continue washing by decantation through the filter until the mineral is completely free from NaOH. Transfer all of the mineral to the filter and proceed directly to the alcohol wash, drying and igniting the mineral as outlined for products other than emery.

PROCEDURE B:

For: Grit sizes 1/2–60 and coarser, Aluminum Oxide, Silicon Carbide and Garnet.
Grit sizes Coarse and Extra Coarse, Emery.
Grit sizes Coarse and Extra Coarse, Flint (paper).

Decant through a 325 mesh wire sieve. Wash the mineral with hot water at least 4 times by decantation through the sieve. Transfer any mineral remaining on the sieve and that in the beaker onto a #4 Whatman filter paper or its equivalent with hot water. Wash once with alcohol. Dry the mineral and filter paper in an oven at 110° ± 5°C. Brush the mineral lightly from the filter paper into a crucible. Ignite over a Bunsen or Meeker burner or in a muffle furnace at 600° ± 20°C for 10 minutes, stirring the mineral once or twice during ignition.

5.1.7 *Recovery procedure for resin over resin-bond coated abrasives containing a mineral filler in either or both adhesive coats.*—Use the procedure for resin over resin-bond coated abrasives containing no mineral filler in adhesive coats (see par. 5.1.6). However, *in the case of Emery grits Fine and Medium* and all coated abrasives having mineral fillers which are insoluble in HCl or too coarse to pass a 325 sieve, separate the mineral filler from the abrasive grain at some point prior to grading. This separation is made by vibratory means with sieves fine enough to retain all of the abrasive grain but coarse enough to pass all of the mineral filler as determined by microscopic examination of both the abrasive grain and the mineral filler, or it is made by any other means that will insure a clean separation of the filler from the abrasive grain with no loss of the abrasive grain.

5.1.8 *Recovery procedure for paper backed waterproof coated abrasives containing no mineral filler in adhesive coats and having adhesive coats which are soluble in denatured alcohol and caustic-water-methanol.*[5]—Take a sufficiently large sample to insure recovery of at least 100 grains (6.5 grams) of abrasive grain for hand sieving, or at least 10 grams of abrasive grain for mechanical sieving. Cut the sample into 1½ in. strips and fold, preferably in a zigzag manner, and place on edge in a 600 ml. beaker. Just cover strips with equal volumes of denatured alcohol or equivalent and caustic-water-methanol solution. Boil until the mineral drops off and remove strips, washing off any adhering mineral with denatured alcohol. Bring solution to boil and hold for 5 minutes. Decant through a Buchner funnel equipped with a #4 Whatman filter paper or its equivalent of sufficient diameter to extend at least ¼ in. up the side of the funnel. Rinse thoroughly with hot water and finally with denatured alcohol.

Remove the filter paper, wash the mineral into a 600 ml. beaker with approximately 100 ml. of hot water, and discard the filter paper. Add an equal volume of c.p. concentrated HCl to the beaker containing the mineral and water and boil approximately 10 minutes, stirring occasionally. Dilute with about 50 ml. of hot water and filter through a #4 Whatman filter paper or its equivalent. Rinse thoroughly, first with hot water and then with denatured alcohol.

Dry filter paper and sample in a drying oven at 110° ± 5°C, and transfer sample to an evaporating dish, and discard filter paper. Ignite over a Bunsen or Meeker burner or in a muffle furnace for 10 minutes at 600° ± 20°C, stirring the mineral once or twice during ignition.

5.1.9 *Recovery procedure for paper backed and other waterproof coated abrasives containing no mineral filler in adhesive coats and having adhesive coats (such as phenol-aldehyde resins) which are insoluble in readily available solvents.*—Use the procedure for resin over resin-bond coated abrasives containing no mineral filler in adhesive coats (see par 5.1.6).

[5] Caustic-water-methanol solution consists of equal parts by volume of a 10% NaOH solution and methanol.

5.1.10 *Recovery procedure for paper backed and other waterproof coated abrasives containing a mineral filler in either or both adhesive coats and having adhesive coats (such as phenol-aldehyde resins) which are insoluble in readily available solvents.*—Use the procedure for resin over resin-bond coated abrasives containing a mineral filler in either or both adhesive coats (see par. 5.1.7).

5.2 SEDIMENTATION GRADES.—The abrasive grain recovery procedures described herein for sedimentation grades insure grain particles which will be wet uniformly by the sedimentation medium without forming air bubbles. Thorough wetting of each particle is necessary to obtain accurate results. These procedures shall be followed in recovering abrasive grain from sedimentation grades of coated abrasive products for grading. The sedimentation grades are listed in paragraph 3.1.1.

5.2.1 *Types of bond.*—Different types of bond as defined in paragraph 3.3, require different recovery procedures, and for descriptive purposes, these procedures have been grouped as follows:

Glue-bond coated abrasives.—Water soluble adhesives.

Waterproof coated abrasives.—Adhesives soluble in readily available solvents.

Resin over glue-bond, resin over resin-bond, and waterproof-coated abrasives.—Adhesives not soluble in readily available solvents.

5.2.2 *Recovery procedure for glue-bond coated abrasives.*—Take a sufficiently large sample to insure at least 2 to 2½ grams of mineral. Cut the sample into approximately 1 in. strips. Fold each strip individually in a zigzag manner and place the strips on edge in a 600 ml. beaker. Add sufficient hot water to cover the strips and heat until the mineral is removed, but do not boil. Wash the pieces of backing with a jet of hot water from a wash bottle, rubbing each strip lightly with the finger tips to make certain that all of the grain is removed.

After the mineral has been removed from the coated sheet, decant the liquid in the beaker through an 11 cm. #42 Whatman filter paper placed in a Bunsen funnel with a platinum cone, using suction, or decant through a #42 Whatman filter paper of sufficient diameter to provide a ½ in. collar when placed in a Buchner funnel, using suction.

To the beaker containing the mineral, add approximately 20 to 40 ml. of a solution of equal parts by volume of c.p. concentrated HCl and water. Bring to a boil and boil for 5 to 7 minutes. Dilute with an equal volume of hot water, decant through the filter paper, and transfer the mineral to the filter paper using hot water. Wash the mineral and filter paper thoroughly with hot water and then with denatured alcohol, or methanol.

Remove the filter paper containing the mineral from the funnel and dry thoroughly in an oven at 110°±5°C. If the mineral shows tendencies of being somewhat caked, break up the loose lumps with a small spatula or stirring rod.

Transfer the filter paper and mineral to a crucible (either nickel or porcelain) and ignite over a Bunsen or Meeker burner or in a muffle furnace at 600°±20°C until the filter paper is completely ashed. During ignition, remove the crucible and stir the contents at least once. Cool and break up any lumps or clustering by working over the grain lightly but thoroughly with the spatula.

5.2.3 *Recovery procedure for waterproof coated abrasives made with*

adhesives which are soluble in denatured alcohol, and caustic-water-methanol.[6]—Take a sufficiently large sample to insure at least 2 to 2½ grams of mineral. Cut the equivalent of one 9 in. x 11 in. sheet into approximately 1 in. strips. Fold individually in a zigzag manner and place on edge in a 600 ml. beaker. Just cover strips with equal volumes of denatured alcohol or equivalent, and caustic-water-methanol solution. Boil until mineral drops off and remove strips, washing off any adhering mineral with denatured alcohol. Bring solution to boil and boil for ten minutes, then filter by means of suction using an 11 cm. #42 Whatman filter paper in a Bunsen funnel with platinum cone. It is optional to use a Buchner funnel and larger filter paper which provides a ½ in. collar on the funnel sizes. Rinse thoroughly with hot distilled water (10 times, approximately 25 ml. each), and with methanol or denatured alcohol (5 times, approximate 25 ml. each).

Remove the filter paper and wash the mineral into a 600 ml. beaker with approximately 100 ml. of hot distilled water. Dry and burn filter paper and add any mineral or residue remaining to the beaker. Add an equal volume of c.p. concentrated HCl to the beaker containing the water and mineral, and boil approximately 10 minutes, stirring occasionally. Dilute with about 50 ml. of hot water, and filter through #42 Whatman filter paper. Rinse thoroughly with hot water (10 times, 25 ml. each); and then with methanol or denatured alcohol (5 times, 25 ml. each).

Dry filter paper and sample in a drying oven at 110°±5°C and then break up all lumps with a spatula. Place filter and mineral in a crucible and ignite over a Bunsen or Meeker burner or in a muffle furnace at 600°±20°C until paper is burned off. Stir sample at least twice before removing from furnace. Break up any lumps or clustering by working over lightly but thoroughly with a spatula.

5.2.4 *Recovery procedure for resin over glue-bond, resin over resin-bond and waterproof coated abrasives made with one or more adhesive coats which are insoluble in readily available solvents.*—Take one 9 in. x 11 in. sheet or a sample sufficiently large to obtain 2 to 2½ grams of mineral. Cut the sample over a sheet of glazed paper into approximately 1 in. squares. Place the squares and any loose mineral collected on the glazed paper into a large crucible or evaporating dish and ignite over a Bunsen or Meeker burner, or in a muffle furnace, at 600°±20°C, stirring occasionally until substantially all that remains is mineral and a small amount of ash. At this point the mineral should be fairly free flowing; if this is not the case, it should be further ignited.

Brush the mineral into a beaker, add 50% NaOH solution and boil for at least 10 minutes. Dilute with an equal volume of water. Decant through a #42 Whatman filter paper or its equivalent in a Buchner funnel using a filter paper which provides a ½ in. collar on the funnel sides. Wash the mineral thoroughly with hot water, by decantation through the filter.

Transfer any mineral on the filter back into the beaker with a jet of hot water and add an equal volume of c.p. concentrated HCl. Heat to boiling and boil for 7 to 10 minutes agitating the mineral once or twice during this time. Dilute and decant through a #42 Whatman filter paper, or its equivalent, in a Buchner funnel. Wash the mineral 3 times by decantation through the filter and, finally,

[6] Ibid. footnote 5.

transfer all of the mineral to the filter paper with hot water. Wash once with denatured alcohol or methanol. Dry the mineral and filter paper in an oven at 110°±5°C. Place the mineral and the filter paper into a crucible and ignite over a Bunsen or Meeker burner or in a muffle furnace at 600°±20°C for 10 minutes or until the paper is completely burned off.

6. GRADING PROCEDURE

6.1 SCREEN GRADING.

6.1.1 *Standard sands.*—Standard sands used for the control of the grading of screen grades are as follows:

6.1.1.1 *For Aluminum Oxide, Silicon Carbide and Garnet:*

Grit size	Type of abrasive	Standard sand [1]	
		Mineral	Date
6/0–220	Aluminum Oxide, Silicon Carbide and Garnet.	Garnet	3/12/52
5/0–180	Aluminum Oxide	do	8/ 5/52
5/0–180	Silicon Carbide and Garnet	do	7/ 1/52
4/0–150	Aluminum Oxide, Silicon Carbide and Garnet.	do	12/23/53
3/0–120	Aluminum Oxide and Silicon Carbide.	do	4/21/55
3/0–120	Garnet	do	2/20/51
2/0–100	Aluminum Oxide and Silicon Carbide.	do	4/16/54
2/0–100	Garnet	do	4/20/50
0–80	Aluminum Oxide	do	4/20/50
0–80	Silicon Carbide and Garnet	do	11/24/52
1/2–60	Aluminum Oxide, Silicon Carbide and Garnet.	do	1/18/55
1–50	Aluminum Oxide, Silicon Carbide and Garnet.	do	6/ 4/53
1½–40	Aluminum Oxide, Silicon Carbide and Garnet.	do	1/10/51
2–36	Aluminum Oxide	do	6/ /43
2–36	Silicon Carbide and Garnet	do	6/30/55
2½–30	Aluminum Oxide	do	3/ 1/56
2½–30	Silicon Carbide and Garnet	do	10/25/49
3–24	Aluminum Oxide	do	6/24/54
3/24	Silicon Carbide and Garnet	do	5/ 9/52
3½–20	Garnet	do	7/27/55
3½–20	Aluminum Oxide and Silicon Carbide.	do	11/ /41
4–16	Aluminum Oxide	Al. Ox	6/11/52
4–16	Silicon Carbide	do	3/ /32
4½–12	Aluminum Oxide and Silicon Carbide.	do	11/10/47

[1] The standard sands designated for Aluminum Oxide, Silicon Carbide, Garnet and Emery may be purchased from the Carborundum Co., Niagara Falls, N.Y. The dates are included for the purpose of identification, and represent the standard sands that are currently in use by the industry.

6.1.1.2 *For Emery:*

Grit	Standard sand [1]	
	Mineral	Date
Fine	Emery	1/5/55
Medium	do	1/5/55
Coarse	do	1/5/55
Extra Coarse	do	1/5/55

[1] The standard sands designated for Aluminum Oxide, Silicon Carbide, Garnet and Emery may be purchased from the Carborundum Co., Niagara Falls, New York. The dates are included for the purpose of identification, and represent the standard sands that are currently in use by the industry.

6.1.1.3 *For Flint (finishing paper):*

Grit size	Standard sand [1]	
	Mineral	Date
4/0	Garnet	3/12/52
3/0	do	8/ 5/52
2/0	do	12/23/53

[1] The standard sand for 4/0 Flint (Finishing Paper) is the same as the standard sand for 6/0–220 Aluminum Oxide, Silicon Carbide and Garnet that for 3/0 is the same as the standard sand for 5/0–108 Aluminum Oxide, and that for 2/0 is the same as the standard sand for 4/0–150 Aluminum Oxide, Silicon Carbide and Garnet. These standard sands may be purchased from the Carborundum Co., Niagara Falls, NY.

6.1.1.4 *For Flint (paper):*

Grit size	Standard sand [1]	
	Mineral	Date
Extra Fine	Quartz	4/1/52
Fine	do	4/1/52
Medium	do	4/1/52
Coarse	do	4/1/52
Extra Coarse	do	4/1/52

[1] The standard sands for Flint (Paper) may be purchased from the Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.

6.1.2 *Standard testing sieves.*—Data for standard testing sieves for the determination of abrasive grain sizes are given in table 4 and consist of the silk and wire sieves listed in tables 5 and 6 for each type of grit and grit size. Standard testing sieves shall be not less than 12 square inches in screening area and shall be carefully selected for mesh count and uniformity of openings, and shall be mounted taut without disturbing either the size or the shape of the openings.

6.1.3 *Method of test.*

6.1.3.1 *Control of screen grades.*—The basis for the control of screen grades consists of a series of "standard sands". These are used to

TABLE 4.—*Standard sieve data*

Sieve designation [1]	Mesh No.	Approximate mesh opening [2]	Mesh count [3] (warp and woof)
		Inches	*Opening per lineal inch*
25 Std. Dufour	196	0. 0025	196
21 Std. Dufour	178	. 0027	178
16 X	157	. 0032	157
15 XX Dufour	150	. 0036	150
13 XX Dufour	129	. 0039	129
11 X Dufour	116	. 0052	116
10 X Dufour	109	. 0058	109
9 Std. Dufour	97	. 0066	97. 5
8 X Dufour	86	. 0079	85. 5
6 Std. Bodmer	74	. 0094	74
5 Std. Dufour	66	. 0111	66
3 Std. Dufour	58	. 0131	58. 5
1 Std. Dufour	49	. 0164	48. 5
40 GG Dufour	39	. 0197	39
38 GG Dufour	37	. 0215	37
32 GG Bodmer	32	. 0250	32
28 GG Dufour	27	. 0304	27. 5
24 GG Bodmer	24	. 0353	24
20 XXXGG Dufour	19	. 0456	19. 5
18 GG Dufour	17	. 0519	17. 5
14 U.S. Std. Wire	14	. 0555	12. 5
12 U.S. Std. Wire	12	. 0661	10. 8
10 U.S. Std. Wire	10	. 0787	9. 2
8 U.S. Std. Wire	8	. 0937	7. 9
6 U.S. Std. Wire	6	. 1320	6. 0

[1] All sieves are of silk bolting cloth except those designated "U.S. Std. Wire". The silk bolting cloth is obtainable from Tobler, Ernst and Traber, Inc., New York, N.Y. The U.S. Standard Wire cloth is available from the Newark Wire Cloth Co., Newark, N.J., and from the W. S. Tyler Co., Cleveland, Ohio.

[2] The approximate mesh opening for each silk represents the mode or aperture of most frequent occurrence in 100 openings measured between warp threads. Measurements made by other methods will give noticeably different results. This should be kept in mind in making comparisons between the figures shown and other figures.

[3] The mesh counts listed are the standard counts of the manufacturers of the silk bolting cloth, adjusted to the nearest full or ½ mesh. Mesh count in the warp is subject to minor variations and is as a rule within ±1% of the standard count. Mesh count in the woof is subject to somewhat greater variations.

test "standard testing sieves" for the purpose of determining their suitability for use (see par. 6.1.3.2), and to provide a reference for evaluating the grading of abrasive grain recovered from the coated sheet (see par. 4.1).

6.1.3.2 *Selection of standard testing sieves.*—The "standard testing sieves" to be used for determining the grading of screen grades are shown in tables 5 and 6. Before they may be considered as being satisfactory for use, they shall be tested by use of "standard sands" in the manner described herein.

If a sieve is used as the control sieve for any type and grit size of abrasive grain, it shall be tested as a control sieve using the "standard sand" for that type and grit size of abrasive grain. It shall be considered as being satisfactory for use as a standard testing sieve only if, and so long as, it yields an overgrade percentage by weight within the limits shown in tables 5 and 6.

If the same sieve is used to test the "coarseness of total grade" or is used as the fines sieve for either a coarser grit size of the same type of abrasive grain or for any grit size of some other type of abrasive grain, it shall be considered as being satisfactory for such use if it has been tested and found to be satisfactory as a control sieve.

Certain sieves, namely, the 25 Std, 18GG, and 12 U.S. Std. are fines sieves only. Each of these shall be tested as a fines sieve using the standard sand for the grit size and type of abrasive grain for which it is a fines sieve. Each shall be considered satisfactory for use as a standard testing sieve only if, and as long as, it yields a fines percentage by weight within the limits shown in Tables 5 and 6.

The 8 U.S. Standard and 6 U.S. Standard wires used for testing the "coarseness of total grade" of grit sizes 4–16 and 4½–12 need not be tested with the standard sands to determine their suitability for such use.

6.1.3.3 *Sampling.*—Abrasive grain samples recovered as described in paragraph 5.1, and standard sands which are to be tested for grading, shall be reduced to proper weight by quartering, as follows:

Place the mineral on a square piece of hard surfaced paper. Grasp diagonally opposite corners of the paper, raise first one corner then the other, causing the grain to roll from the center of the sheet toward one corner, then across toward the opposite corner, and then back to the center. Next, grasp the other two diagonally opposite corners and repeat the procedure. Continue mixing in this manner for at least five complete cycles in each direction and finally shape the mineral into a flat circular pile in the center of the sheet.

By means of a large spatula inserted from the top of the pile of mineral, carefully split the pile first into halves and then into quarters. In each operation the edge of the spatula should be held firmly against the paper so that all of the mineral is removed. Using a spatula, and a camel hair brush if necessary, completely remove two diagonally opposite quarters.

Repeat this entire procedure with the remaining mineral except after mixing remove the quarters at 90° to those previously removed. Continue repeating the procedure removing alternate quarters after each mixing until substantially the amount required for testing remains. 100 grains (6.5 grams) shall be the weight of the standard sample for hand sieving, or 10 grams for mechanical sieving. Minor adjustments to the final amount may be made by use of a spatula.

6.1.3.4 *Conditioning.*—All quartered samples and test equipment shall be conditioned at 70°±2° F. and 50%±2% relative humidity for at least 8 hours before testing and shall remain under these controlled conditions until all testing is completed.

6.1.3.5 *Hand sieving.*—Grading shall be determined by hand sieving under controlled conditions of 70°±2° F., and 50%±2% relative humidity. The mineral shall be tested first through the fines sieves and then through the control sieve. That portion of the grade remaining on the control sieve shall then be tested through the coarser sieves to determine compliance with respect to the limits given in tables 1 and 2. The sieves shall be shaken in substantially a horizontal position by striking the side of the sieve frame against the palm of the hand. A stroke of approximately one inch shall be used and the rate of shaking shall be approximately 275 strokes a minute. The sieve frames shall not be struck with or against any hard object during sieving. Shaking shall be continued with each sieve until the amount of mineral passing through the sieve is equal to or less than one grain weight a minute.

TABLE 5.—*Method for selecting and determining sieving characteristics of sieves by means of standard sands for aluminum oxide, silicon carbide and garnet. (These sieves are then used for the testing of the recovered abrasive grits.)* [1]

Grit size	Type of abrasive	Sieve for 100% passage	Sieve for 99.5% passage	Control sieve	Overgrade percentage [2]		Fines sieve	Fines percentage [2]	
					Min.	Max.		Min.	Max.
6/0–220	Aluminum Oxide, Silicon Carbide and Garnet	13 XX	15 XX	21 Std.	5. 1	9. 1	25 Std.	45. 4	65. 4
5/0–180	Aluminum Oxide	11 X	13 XX	15 XX	7. 3	13. 3	21 Std.	---	----
5/0–180	Silicon Carbide and Garnet	11 X	13 XX	15 XX	9. 5	15. 5	21 Std.	---	----
4/0–150	Aluminum Oxide, Silicon Carbide and Garnet	9 Std.	11 X	13 XX	6. 7	12. 7	15 XX	---	----
3/0–120	Aluminum Oxide, Silicon Carbide	6 Std.	9 Std.	11 X	10. 9	16. 9	13 XX	---	----
3/0–120	Garnet	6 Std.	9 Std.	11 X	5. 5	11. 5	13 XX	---	----
2/0–100	Aluminum Oxide, Silicon Carbide	3 Std.	6 Std.	9 Std.	3. 0	6. 0	11 X	---	----
2/0–100	Garnet	3 Std.	6 Std.	9 Std.	6. 3	12. 3	11 X	---	----
0–80	Aluminum Oxide	1 Std.	3 Std.	6 Std.	8. 4	14. 4	9 Std.	---	----
0–80	Silicon Carbide and Garnet	1 Std.	3 Std.	6 Std.	3. 0	5. 3	9 Std.	---	----
½–60	Aluminum Oxide, Silicon Carbide and Garnet	38 GG	1 Std.	3 Std.	4. 4	8. 4	6 Std.	---	----
1–50	Aluminum Oxide, Silicon Carbide and Garnet	32 GG	38 GG	1 Std.	3. 0	6. 4	3 Std.	---	----
1½–40	Aluminum Oxide, Silicon Carbide and Garnet	28 GG	32 GG	38 GG	3. 0	6. 0	1 Std.	---	----
2–36	Aluminum Oxide	24 GG	28 GG	32 GG	9. 7	15. 7	38 GG	---	----
2–36	Silicon Carbide and Garnet	24 GG	28 GG	32 GG	5. 3	9. 3	38 GG	---	----
2½–30	Aluminum Oxide	20 XXXGG	24 GG	28 GG	3. 0	7. 0	32 GG	---	----
2½–30	Silicon Carbide and Garnet	20 XXXGG	24 GG	28 GG	14. 6	20. 6	32 GG	---	----
3–24	Aluminum Oxide	14 US Std.	20 XXXGG	24 GG	8. 6	14. 6	28 GG	---	----
3–24	Silicon Carbide and Garnet	14 US Std.	20 XXXGG	24 GG	8. 3	14. 3	28 GG	---	----
3½–20	Garnet	10 US Std.	14 US Std.	20 XXXGG	3. 0	6. 9	24 GG	---	----
3½–20	Aluminum Oxide and Silicon Carbide	10 US Std.	14 US Std.	20 XXXGG	3. 7	7. 7	24 GG	---	----
4–16	Aluminum Oxide	8 US Std.	10 US Std.	14 US Std.	10. 5	16. 5	18 GG	20. 4	30. 4
4–16	Silicon Carbide	8 US Std.	10 US Std.	14 US Std.	9. 6	15. 6	18 GG	15. 6	25. 6
4½–12	Aluminum Oxide and Silicon Carbide	6 US Std.	8 US Std.	10 US Std.	7. 0	13. 0	12 US Std.	34. 0	54. 0

[1] For detailed information on sieves, see Table 4.

[2] If a sieve does not separate the standard sand within these limits it must be discarded (see 6.1.3.2).

TABLE 6.—*Method for selecting and determining sieving characteristics of sieves by means of standard sands for emery and flint. (These sieves are then used for the testing of the recovered abrasive grits)* [1]

Grit size	Type of abrasive	Sieve for 100% passage	Sieves for 99.5% passage	Control sieve	Overgrade percentage [2]		Fines sieve	Fines percentage [2]	
					Min.	Max.		Min.	Max.
Fine	Emery	5 Std.	8 X	13 XX	7. 3	15. 3	21 Std.	----	----
Medium	do	40 GG	5 Std.	8 X	4. 6	10. 6	13 XX	----	----
Coarse	do	28 GG	40 GG	5 Std.	4. 3	12. 3	9 Std.	----	----
Extra Coarse	do	20 XXXGG	24 GG	1 Std.	7. 5	15. 5	5 Std.	----	----
4/0	Flint (finishing paper)	13 XX	15 XX	21 Std.	5. 1	9. 1	25 Std.	45. 4	65. 4
3/0	do	11 X	13 XX	15 XX	7. 3	13. 3	21 Std.	----	----
2/0	do	9 Std.	11 X	13 XX	6. 7	12. 7	15 XX	----	----
Extra Fine	Flint (paper)	5 Std.	10 X	16 X	12. 5	20. 5	25 Std.	20. 0	50. 0
Fine	do	40 GG	5 Std.	10 X	6. 0	14. 0	16 X	----	----
Medium	do	28 GG	40 GG	5 Std.	6. 0	14. 0	10 X	----	----
Coarse	do	24 GG	28 GG	40 GG	4. 1	12. 1	5 Std.	----	----
Extra Coarse	do	20 XXXGG	24 GG	28 GG	3. 6	9. 6	40 GG	----	----

[1] For detailed information on sieves see table 4.
[2] If a sieve does not separate the standard sand within these limits, it must be discarded (see 6.1.3.2`,

6.1.3.6 *Mechanical sieving (alternate).*—As an alternative method of test, a mechanical shaker may be used provided that:

(1) All grading tests are made under controlled conditions of 70°±2° F. and 50%±2% relative humidity;

(2) A 10 gram sample of mineral is used for calibration of standard testing sieves and grading determinations;

(3) The control sieve is positioned directly above the fines sieve in the machine so that when the mineral under test is placed on the control sieve, that portion of it passing the control sieve will feed directly to the fines sieve;

(4) The machine is so adjusted that rate of shaking is approximately 275 complete strokes or cycles a minute;

(5) The length of test is 2750 complete strokes or cycles;

(6) Screening action is such that when the standard testing sieves are calibrated with the standard sands as outlined under "Selection of and limits for standard testing sieves", (see par. 6.1.3.2), they yield overgrade and fines percentages by weight within the limits specified.

(7) After weighing the overgrade, control, and fines fractions the overgrade is then rescreened in the same manner through the two coarse sieves to determine its compliance with respect to the limits given in tables 1 and 2.

6.1.3.7 *Presentation of data (example of normal grading result).*—The following illustrates a normal grading result for a 3/0–120 Aluminum Oxide coated abrasive product as obtained by recovering the abrasive grain from the coated sheet and testing it according to the procedures described herein:

Grading Example for 3/0-120 Aluminum Oxide

Percent	Std. Sand	Sample	Limits
Percent through 6 Std	------	100. 0	Substantially 100% (all but a trace).
Percent through 9 Std	------	99. 7	99.5 Min.
Percent on 11 X	13. 9	12. 0	16.7 Max. (6/5 Std.)
Percent on 13 XX	59. 4	63. 0	
Percent through 13 XX	26. 7	25. 0	19.7 Min. (Std. −7). 36.7 Max. (Std. +10)

6.1.3.8 *Referee test.*—Whenever grading is a point of issue, duplicate tests shall be made of the mineral in question and its standard sand, and in each instance the standard sand shall be tested either immediately before or after the mineral in question.

6.2 SEDIMENTATION GRADING.

6.2.1 *Theory of grading by sedimentation.*—The method of determining the particle size or grading of a mineral by sedimentation is based on Stokes' Law which, as applied to small spheres falling in a viscous liquid, may be expressed in the following form:

(1) $$\frac{V=2\ gr^2\ (p-d)}{9n}$$

V=Settling velocity of the falling particle in centimeters per second.

g=Acceleration due to gravity, 980 centimeters per second per second.[7]
r=Effective particle radius in centimeters.
p=Density of the particles in grams per cubic centimeter.
d=Density of the settling medium in grams per cubic centimeter.
n=Viscosity of the settling medium in poises, i.e., in dyne seconds per square centimeter.

From equation (1):

(2) r (in cm) $=\sqrt{\frac{9nV}{2g(p-d)}}$

D =Effective particle diameter in microns= 10,000 (2r) because 1 cm=10,000 microns.

Therefore;

(3) D (in microns) $=20{,}000\sqrt{\frac{9nV}{2g(p-d}}$

L =Length of settling tube in centimeters.
T =Time of settling in minutes.
V (in centimeters per second) $=\frac{L}{60T}$ and

(4) D (in microns) $=20{,}000\sqrt{\frac{9nL}{2g(p-d)\ 60T}}$

The terms n, L, g, p, and d are all constant for a given settling medium, temperature, grain, locality and equipment, therefore

$$20{,}000\sqrt{\frac{9nL}{2g(p-d)\ 60}}$$

may be considered as a constant, K, and equation (4) may be written in the following form:

(5) D (in microns) $=K\sqrt{\frac{1}{T}}=\frac{K}{\sqrt{T}}$

In applying equation (5), it is, of course, necessary to compute the value of K for each temperature and for each type of mineral since K is dependent not only upon L, g, and p, but also upon d and n, the density and viscosity of the settling medium, respectively, both of which are variables with respect to temperature.

For the purpose of determining particle size by sedimentation, the minerals normally used for coated abrasives have generally been considered as having densities as follows:

Silicon Carbide	–3.22 grams per cc.
Aluminum Oxide	–3.96 grams per cc.
Garnet	–3.85 grams per cc.
Flint	–2.61 grams per cc.

[7] The value of g, the acceleration due to gravity, depends upon altitude and latitude. The International Committee on Weights and Measures has adopted as an acceptable value a figure of 890.665 cm per second per second. However, the value 980 may be used as sufficiently accurate.

6.2.2 *Standard sedimentation apparatus.*[8]—The sedimentation apparatus to be used for the determination of the grading of sedimentation grades shall consist of the following elements which shall be assembled as shown in figure 3.

(1) Glass water jacket, length 87 to 90 cm.; diameter 6 to 9 cm.
(2) Sedimentation tube, length 94 cm.; inside diameter 20 mm. ± ½ mm. This tube shall be perfectly cylindrical.
(3) Collecting tube of special design equal in all respects to that shown in figure 3.[9] The end of the tube shall be square with the walls, and the first etched graduation shall be accurate.

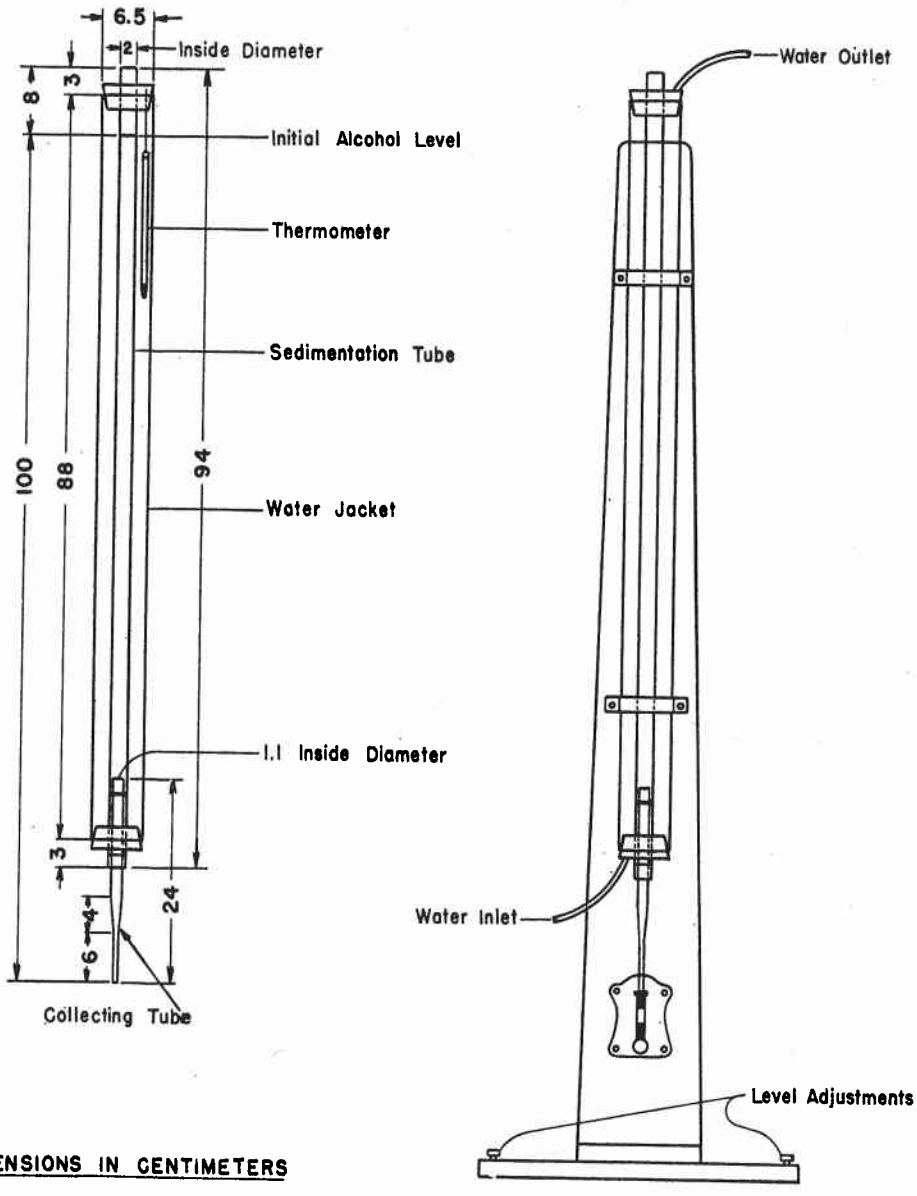

FIGURE 3.—*Assembly of Standard Sedimentation Apparatus.*

[8] The Standard Sedimentation Apparatus and the Standard Sedimentation Medium may be obtained from Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn.
[9] May be obtained from Fischer Scientific Co., 717 Forbes Street, Pittsburgh 19, Pa.

(4) Thermometer graduated from 0° C. to 100° C. accurate to ±0.2° C.

(5) Stop watch or accurate electric clock capable of being read to 1/100 of a minute.

(6) Frame equipped with the necessary rings and fittings to hold the glass water jacket, sedimentation tube and collecting tube.

(7) A 1 in. metal base plate large enough and heavy enough to give stability to the apparatus, drilled for mounting the frame and equipped with adjusting screws to permit adjustment of the assembly to a vertical position.

(8) The following accessories:

(a) Test tube.
(b) Wash bottle.
(c) Plum bob.
(d) Rubber stopper.
(e) Magnifying glass.
(f) Seamless funnel.
(g) Meter stick.
(h) Rubber policeman.

6.2.3 *Standard sedimentation medium.*[10]—The sedimentation medium shall consist of a mixture of 95% methyl alcohol and 99% methyl alcohol (synthetic methanol) which has been carefully blended so as to give the micron values listed herein for the checking minerals in accordance with the procedure outlined.

6.2.4 *Identification.*—The sedimentation grades of coated abrasive grain covered by this standard and the identification of their standard particle size accumulation curves which are shown in figures 1 and 2 are as follows:

6.2.4.1 *For waterproof coated abrasives:*

Grade	Minerals	Standard Curve [1]
600	Aluminum Oxide and Silicon Carbide	600 dated 9/12/35
500	Aluminum Oxide and Silicon Carbide	500 dated 3/18/37
400	Aluminum Oxide and Silicon Carbide	400 dated 2/ 6/36
360	Aluminum Oxide and Silicon Carbide	360 dated 9/13/33
320	Aluminum Oxide and Silicon Carbide	320 dated 9/13/33
280	Aluminum Oxide and Silicon Carbide	280 dated 9/13/33
240	Aluminum Oxide and Silicon Carbide	240 dated 9/13/33
8/0	Garnet	280 dated 3/17/37
7/0	Garnet	240 dated 3/17/37

[1] These dates are included for the purpose of identification and represent the Standard Particle Size Accumulation Curves currently in use by the industry.

6.2.4.2 *For coated abrasives other than waterproof:*

Grade	Minerals	Standard Curve [1]
500	Aluminum Oxide and Silicon Carbide	500 dated 3/17/37
400	Aluminum Oxide and Silicon Carbide	400 dated 3/17/37
360	Aluminum Oxide and Silicon Carbide	360 dated 3/17/37
320	Aluminum Oxide and Silicon Carbide	320 dated 3/17/37
280	Aluminum Oxide and Silicon Carbide	280 dated 3/17/37
240	Aluminum Oxide and Silicon Carbide	240 dated 3/17/37
8/0	Garnet	280 dated 3/17/37
7/0	Garnet	240 dated 3/17/37
7/0	Flint	320 dated 3/17/37
6/0	Flint	280 dated 3/17/37
5/0	Flint	240 dated 3/17/37

[1] These dates are included for the purpose of identification and represent the Standard Particle Size Accumulation Curves currently in use by the industry.

[10] See footnote [8].

6.2.4.3 *Curves of checking minerals.*—The micron values of the standard checking minerals are shown in figure 4.

6.2.5 *Methods of test.*

6.2.5.1 *Control of sedimentation grades.*—The basis for the control of sedimentation grades consists of a set of curves for "standard checking minerals"[11] as shown in figure 4, and a series of standard particle size accumulation curves called "standard curves" as shown in figures 1 and 2. The checking minerals are used to calibrate the sedimentation apparatus and to check the sedimentation medium and testing technique. The standard curves are used as references to determine conformity with the grading limits for sedimentation grades.

The grading of a sedimentation grade shall be determined and referred to its standard curve only after the assembled sedimentation apparatus, settling medium, and testing technique have been checked and calibrated as outlined under "Calibration of equipment" (par. 6.2.5.2) and the micron values obtained agree with those listed in figure 4 within the limits specified in 6.2.5.2.

6.2.5.2 *Calibration of equipment.*—After the sedimentation apparatus has been assembled, it shall be checked for several important variables any one of which might easily impair the accuracy of results. First, check the perpendicularity of the assembled stack by means of the plumb bob on a fine thread suspended on a cross wire from the top of the sedimentation tube in such a manner that the thread passes down through the collecting tube. If the thread does not pass through the center of both the sedimentation tube and the collecting tube, adjust the perpendicularity of the stack by means of the level adjusting screws in the base plate until this condition is satisfied.

The collecting tube shall be positioned so that it samples the center of the settling column and should be held firmly in place by a rubber washer located about 3 cm. from the top of the tube so that eddy currents will not be set up in the settling medium when the rubber stopper under the collecting tube is tapped. The sedimentation tube shall be assembled so that the column of settling medium is exactly 100 cm. in length.

After the apparatus has been checked for proper assembly, as outlined above, the overall accuracy of the test shall be determined by grading one or more test tube samples of the checking minerals. Overall accuracy shall be measured by a consideration of the micron values at the 10, 20, 30, 40 and 50 height-percent points. The values at each of these points as read from the accumulation curves obtained by testing the checking minerals should agree within ± 0.5 micron with those listed in figure 4, and the average of the algebraic sum of the deviations shall not exceed ± 0.3 micron. If both of these conditions are satisfied it shall be considered that all elements of the test are as they should be and that the grading of a sedimentation grade may be determined and referred to its standard curve. If either or both of these conditions are not satisfied, it shall be considered that either the equipment is not in proper adjustment, the technique of performing the test is in error, or the sedimentation medium is of improper density and/or viscosity. The equipment shall then be rechecked and adjusted, testing procedure shall be scrutinized and

[11] A set of the Standard Checking Minerals may be obtained from the Minnesota Mining and Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn. These checking minerals have been treated according to the procedure outlined for preparing sedimentation grades, and need no further treatment to insure good wetting.

Curves of Checking Minerals

Height %	Micron Size 280	320
0	74.7	75.1
3	62.1	58.7
10	52.9	49.8
20	47.9	44.2
30	44.7	40.5
40	42.0	37.5
50	39.7	34.9
60	37.4	32.5
70	35.0	30.1
80	32.3	27.5
90	28.8	24.4
100	20.0	16.5

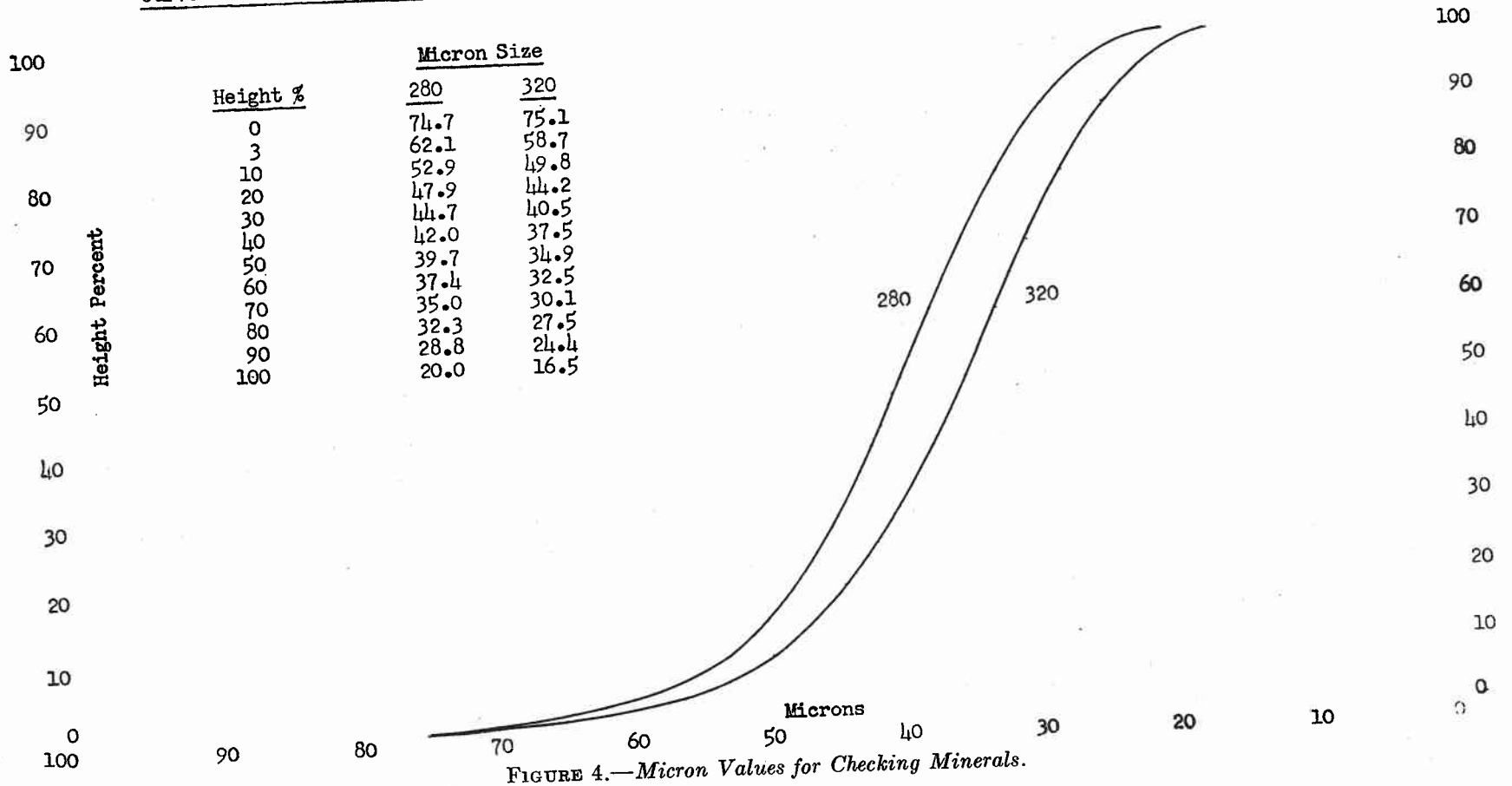

FIGURE 4.—*Micron Values for Checking Minerals.*

further tests shall be made with new lots of sedimentation medium and the checking minerals until the cause of the incorrect results has been determined and corrected.

6.2.5.3 *Grading technique and analyses.*—Grading analyses shall be made in several steps as follows:

(1) Thoroughly mix the mineral to be graded by either rolling or by quartering. Place a sufficient amount of the sample in a test tube to insure 20 to 25 intervals in the collecting tube when it is sedimented. Add 15 ml of the settling medium and gently work over the mineral in the test tube with a standard rubber policeman until no lumps are visible in the bottom of the tube on shaking and quickly rolling the tube over into a horizontal position with the thumb held lightly over the open end of the tube. The mineral and the sedimentation medium should be allowed to remain in the test tube at least ½ hour, and preferably one hour, and should be shaken vigorously three times during this period. During the soaking period the temperature of the sedimentation medium in the test tube should be kept the same as that of the sedimentation medium in the sedimentation tube.

(2) Fill the sedimentation tube with sedimentation medium to a point 100 cm. from the botton of the collecting tube and allow to stand until the temperature comes to equilibrium with the temperature of the water in the water jacket surrounding the sedimentation tube. Check the temperature of the sedimentation tube, the temperature of the water in the water jacket, and the temperature of the sedimentation medium in the test tube to insure that all are the same and are within the range of 20° C. to 30° C.

(3) Place a suitable funnel on the sedimentation tube. With the thumb held lightly over the open end of the test tube containing the mineral and sedimentation medium, shake the tube vigorously for at least 30 seconds. Transfer its contents rapidly to the sedimentation tube by holding the test tube inverted with the open end level with the top of the funnel so that when the sample is released it will flow down the slope of the funnel and onto the top of the settling medium.

(4) Record the time of transfer as the time of the start of settling. Quickly remove the funnel from the top of the sedimentation tube to prevent any mineral from dropping into the tube after settling has begun, because this will distort the results.

(5) The time of the initial point shall be considered as the time when the first steady stream of mineral particles arrives at the bottom of the collecting tube. Examine the falling particles to determine if the cleaning procedure has been adequate. Agglomeration and flakes of ash indicate incorrect or inadequate mineral preparation. Should such a condition exist, discard the analysis.

(6) Take subsequent points as the level of the mineral rises just past the etched graduations. Consider the end point of the grade as the time when all the mineral particles have settled, that is, when the column of mineral will not rise on standing.

(7) Tap the rubber stopper at the bottom of the collecting tube gently but constantly during the time that the mineral particles are falling in order to pack the particles and to keep them level, thus making accurate readings possible. For this tapping use a pencil around one end of which has been placed a 1-in. piece of rubber suction tubing. Confine the tapping to the front quarter of the rubber stopper beneath the collecting tube. No tapping should be

done on the metal arm supporting the sedimentation tube, or on the collecting tube itself.

6.2.5.4 *Presentation of data.*—A "height-percent table", table 3, and a set of "time-diameter tables", tables 7 through 10, are used in presenting grading results determined by sedimentation. The height-percent table shows the accumulated height percent (H%) represented by each point sedimented for total points sedimented ranging from 20.0 to 25.0 graduations. The time-diameter tables show the effective diameter of the various particles in microns for different settling times when the sedimentation medium is at 25° C.

After the various settling times have been determined, obtain from the height-percent table and appropriate time-diameter table the H% and micron size represented by each point sedimented and plot an accumulation curve with micron size as the abscissa and H% as the ordinate. On the same graph and in the same way plot from the 3% point to the 50% point, the standard curve or curves for the coated abrasive product being tested.

Sedimentation time-diameter tables for temperatures of the sedimentation medium other than 25° C., may be computed by means of the following procedure which was used in preparing tables 7 through 10.

(5) $D=\frac{K}{\sqrt{T}}$

Where: D=Diameter in microns
T=Settling Time in minutes.

Since T is in minutes, then, at one minute:

D=K= 91.1 for Silicon Carbide
= 79.7 for Aluminum Oxide
= 81.1 for Garnet
=105.3 for Flint

Calculation of K:

$$\text{Constant } K=20{,}000\sqrt{\frac{9n\ L}{2g(p-d)60}}$$

Where n= 0.00656 at 25° C.
L=100.
g=980
p= 3.22 for Silicon Carbide
= 3.96 for Aluminum Oxide
= 3.85 for Garnet
= 2.61 for Flint
d= 0.800 at 25° C.

At other settling medium temperatures between 20° C. and 30° C., the 25 ° C. value of K may be corrected as follows

K for SiC =109.6 −0.741×t
K for Al_2O_3 = 96.16−0.657×t
K for Garnet= 98.0 −0.675×t
K for Flint =127.1 −0.871×t
Where: t=Temperature in degrees centigrade.

TABLE 7.—*Sedimentation Time-Diameter Values for Aluminum Oxide at 25° C.*

TIME	DIAM.	TIME	DIAM.	TIME	DIAM.
(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)
.50	112.71	3.50	42.60	8.00	28.18
.55	107.47	.55	42.30	.20	27.83
.60	102.89	.60	42.00	.40	27.49
.65	98.86	.65	41.71	.60	27.17
.70	95.27	.70	41.43	.80	26.86
.75	92.03	.75	41.15	9.00	26.56
.80	89.11	.80	40.88	.20	26.27
.85	86.45	.85	40.61	.40	25.99
.90	84.01	.90	40.35	.60	25.72
.95	81.78	.95	40.10	.80	25.46
1.00	79.70	4.00	39.85	10.00	25.20
.05	77.78	.05	39.60	.20	24.96
.10	75.99	.10	39.36	.40	24.71
.15	74.33	.15	39.12	.60	24.48
.20	72.76	.20	38.89	.80	24.25
.25	71.29	.25	38.66	11.00	24.03
.30	69.91	.30	38.43	.20	23.81
.35	68.59	.35	38.21	.40	23.60
.40	67.36	.40	37.99	.60	23.40
.45	66.19	.45	37.78	.80	23.20
.50	65.07	.50	37.57	12.00	23.01
.55	64.02	.55	37.36	.50	22.54
.60	63.00	.60	37.16	13.00	22.10
.65	62.04	.65	36.96	.50	21.69
.70	61.12	.70	36.76	14.00	21.30
.75	60.25	.75	36.57	.50	20.93
.80	59.40	.80	36.37	15.00	20.57
.85	59.59	.85	36.19	.50	20.24
.90	57.82	.90	36.00	16.00	19.92
.95	57.07	.95	35.82	.50	19.62
2.00	56.35	5.00	35.64	17.00	19.33
.05	55.66	.10	35.29	.50	19.05
.10	54.99	.20	34.95	18.00	18.78
.15	54.35	.30	34.62	.50	18.53
.20	53.73	.40	34.29	19.00	18.28
.25	53.13	.50	33.98	.50	18.04
.30	52.55	.60	33.67	20.00	17.82
.35	51.99	.70	33.38	.50	17.60
.40	51.44	.80	33.09	21.00	17.39
.45	50.92	.90	32.81	22.00	16.99
.50	50.40	6.00	32.54	23.00	16.61
.55	49.91	.10	32.26	24.00	16.26
.60	49.42	.20	32.00	25.00	15.94
.65	48.96	.30	31.75	26.00	15.63
.70	48.50	.40	31.50	27.00	15.33
.75	48.06	.50	31.26	28.00	15.06
.80	47.63	.60	31.02	29.00	14.80
.85	47.21	.70	30.79	30.00	14.55
.90	46.80	.80	30.56	32.00	14.08
.95	46.40	.90	30.34	34.00	13.66
3.00	46.01	7.00	30.13	36.00	13.28
.05	45.63	.10	29.91	38.00	12.93
.10	45.26	.20	29.70	40.00	12.60
.15	44.90	.30	29.49	42.00	12.29
.20	44.55	.40	29.29	44.00	12.01
.25	44.21	.50	29.10	46.00	11.75
.30	43.87	.60	28.91	48.00	11.50
.35	43.54	.70	28.72	50.00	11.27
.40	43.22	.80	28.53	55.00	10.84
.45	42.90	.90	28.35	60.00	10.29

TABLE 8.—*Sedimentation Time-Diameter Values for Silicon Carbide at 25° C.*

TIME	DIAM.	TIME	DIAM.	TIME	DIAM.
(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)
0. 50	128. 8	3. 50	48. 69	8. 00	32. 20
. 55	122. 8	. 55	48. 35	. 20	31. 81
. 60	117. 6	. 60	48. 01	. 40	31. 43
. 65	112. 9	. 65	47. 68	. 60	31. 06
. 70	108. 8	. 70	47. 36	. 80	30. 71
. 75	105. 1	3. 75	47. 04	9. 00	30. 36
. 80	101. 8	. 80	46. 73	. 20	30. 03
. 85	98. 8	. 85	46. 42	. 40	29. 71
. 90	96. 0	. 90	46. 13	. 60	29. 40
. 95	93. 4	. 95	45. 83	. 80	29. 10
1. 00	91. 10	4. 00	45. 55	10. 00	28. 80
. 05	88. 91	. 05	45. 26	. 20	28. 52
. 10	86. 92	. 10	44. 99	. 40	28. 24
. 15	84. 95	. 15	44. 72	. 60	27. 98
. 20	83. 16	. 20	44. 45	. 80	27. 72
1. 25	81. 48	4. 25	44. 19	11. 00	27. 46
. 30	79. 91	. 30	43. 93	. 20	27. 22
. 35	78. 41	. 35	43. 68	. 40	26. 98
. 40	76. 99	. 40	43. 43	. 60	26. 74
. 45	75. 65	. 45	43. 18	. 80	26. 52
1. 50	74. 38	4. 50	42. 94	12. 00	26. 29
. 55	73. 17	. 55	42. 70	. 50	25. 76
. 60	72. 02	. 60	42. 47	13. 00	25. 27
. 65	70. 92	. 65	42. 24	. 50	24. 79
. 70	69. 87	. 70	42. 02	14. 00	24. 34
1. 75	68. 86	4. 75	41. 80	. 50	23. 92
. 80	67. 90	. 80	41. 58	15. 00	23. 52
. 85	66. 98	. 85	41. 36	. 50	23. 13
. 90	66. 09	. 90	41. 15	16. 00	22. 77
. 95	65. 23	. 95	40. 94	. 50	22. 43
2. 00	64. 41	5. 00	40. 74	17. 00	22. 09
. 05	63. 63	. 10	40. 34	. 50	21. 77
. 10	62. 86	. 20	39. 95	18. 00	21. 47
. 15	62. 13	. 30	39. 57	. 50	21. 18
. 20	61. 42	. 40	39. 20	19. 00	20. 90
2. 25	60. 73	5. 50	38. 84	. 50	20. 64
. 30	60. 07	. 60	38. 49	20. 00	20. 37
. 35	59. 42	. 70	38. 15	. 50	20. 12
. 40	58. 80	. 80	37. 82	21. 00	19. 87
. 45	58. 20	. 90	37. 50	22. 00	19. 42
2. 50	57. 61	6. 00	37. 19	23. 00	18. 99
. 55	57. 05	. 10	36. 88	24. 00	18. 59
. 60	56. 49	. 20	36. 58	25. 00	18. 22
. 65	55. 96	. 30	36. 29	26. 00	17. 86
. 70	55. 44	. 40	36. 01	27. 00	17. 53
2. 75	54. 93	6. 50	35. 73	28. 00	17. 21
. 80	54. 44	. 60	35. 46	29. 00	16. 91
. 85	53. 96	. 70	35. 19	30. 00	16. 63
. 90	53. 49	. 80	34. 93	32. 00	16. 10
. 95	53. 04	. 90	34. 68	34. 00	15. 62
3. 00	52. 59	7. 00	34. 43	36. 00	15. 18
. 05	52. 16	. 10	34. 19	38. 00	14. 77
. 10	51. 74	. 20	33. 95	40. 00	14. 40
. 15	51. 32	. 30	33. 71	42. 00	14. 05
. 20	50. 93	. 40	33. 49	44. 00	13. 73
3. 25	50. 53	7. 50	33. 26	46. 00	13. 43
. 30	50. 15	. 60	33. 04	48. 00	13. 14
. 35	49. 77	. 70	32. 83	50. 00	12. 88
. 40	49. 40	. 80	32. 61	55. 00	12. 28
. 45	49. 04	. 90	32. 41	60. 00	11. 76

TABLE 9.—*Sedimentation Time-Diameter Values for Garnet at 25° C.*

TIME	DIAM.	TIME	DIAM.	TIME	DIAM.
(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)
0. 50	114. 69	3. 50	43. 35	8. 00	28. 67
. 55	109. 35	. 55	43. 04	. 20	28. 32
. 60	104. 71	. 60	42. 74	. 40	27. 98
. 65	100. 59	. 65	42. 45	. 60	27. 65
. 70	96. 93	. 70	42. 16	. 80	27. 33
. 75	93. 64	. 75	41. 88	9. 00	27. 03
. 80	90. 67	. 80	41. 60	. 20	26. 73
. 85	87. 97	. 85	41. 33	. 40	26. 45
. 90	85. 49	. 90	41. 06	. 60	26. 17
. 95	83. 21	. 95	40. 80	. 80	25. 90
1. 00	81. 10	4. 00	40. 55	10. 00	25. 64
. 05	79. 15	. 05	40. 30	. 20	25. 39
. 10	77. 32	. 10	40. 05	. 40	25. 14
. 15	75. 63	. 15	39. 81	. 60	24. 91
. 20	74. 03	. 20	39. 57	. 80	24. 67
. 25	72. 54	. 25	39. 34	11. 00	24. 45
. 30	71. 13	. 30	39. 11	. 20	24. 23
. 35	69. 80	. 35	38. 88	. 40	24. 02
. 40	68. 54	. 40	38. 66	. 60	23. 81
. 45	67. 35	. 45	38. 44	. 80	23. 60
. 50	66. 22	. 50	38. 23	12. 00	23. 41
. 55	65. 14	. 55	38. 02	. 50	22. 93
. 60	64. 11	. 60	37. 81	13. 00	22. 49
. 65	63. 13	. 65	37. 61	. 50	22. 07
. 70	62. 20	. 70	37. 40	14. 00	21. 67
. 75	61. 30	. 75	37. 21	. 50	21. 29
. 80	60. 45	. 80	37. 01	15. 00	20. 94
. 85	59. 62	. 85	36. 82	. 50	20. 59
. 90	58. 83	. 90	36. 63	16. 00	20. 27
. 95	58. 07	. 95	36. 45	. 50	19. 96
2. 00	57. 34	5. 00	36. 27	17. 00	19. 66
. 05	56. 64	. 10	35. 91	. 50	19. 38
. 10	55. 96	. 20	35. 56	18. 00	19. 11
. 15	55. 31	. 30	35. 22	. 50	18. 85
. 20	54. 67	. 40	34. 90	19. 00	18. 60
. 25	54. 06	. 50	34. 58	. 50	18. 36
. 30	53. 47	. 60	34. 27	20. 00	18. 13
. 35	52. 90	. 70	33. 97	. 50	17. 91
. 40	52. 35	. 80	33. 67	21. 00	17. 65
. 45	51. 81	. 90	33. 38	22. 00	17. 29
. 50	51. 29	6. 00	33. 11	23. 00	16. 91
. 55	50. 78	. 10	32. 83	24. 00	16. 55
. 60	50. 29	. 20	32. 57	25. 00	16. 22
. 65	49. 82	. 30	32. 31	26. 00	15. 90
. 70	49. 35	. 40	32. 05	27. 00	15. 60
. 75	48. 90	. 50	31. 81	28. 00	15. 32
. 80	48. 46	. 60	31. 56	29. 00	15. 06
. 85	48. 04	. 70	31. 33	30. 00	14. 80
. 90	47. 62	. 80	31. 10	32. 00	14. 33
. 95	47. 21	. 90	30. 87	34. 00	13. 90
3. 00	46. 82	7. 00	30. 65	36. 00	13. 51
. 05	46. 43	. 10	30. 43	38. 00	13. 15
. 10	46. 06	. 20	30. 22	40. 00	12. 82
. 15	45. 69	. 30	30. 01	42. 00	12. 51
. 20	45. 33	. 40	29. 81	44. 00	12. 22
. 25	44. 98	. 50	29. 61	48. 00	11. 70
. 30	44. 64	. 60	29. 41	50. 00	11. 46
. 35	44. 30	. 70	29. 22	55. 00	10. 93
. 40	43. 98	. 80	29. 03	60. 00	10. 47
. 45	43. 66	. 90	28. 85		

TABLE 10.—*Sedimentation Time-Diameter Values for Flint at 25° C.*

TIME	DIAM.	TIME	DIAM.	TIME	DIAM.
(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)
0. 50	148. 9	3. 55	55. 88	7. 10	39. 51
. 55	141. 9	. 60	55. 49	.	39. 24
. 60	135. 9	. 65	55. 11	. 30	38. 97
. 65	130. 6	. 70	54. 74	. 40	38. 71
. 70	125. 8	. 75	54. 37	. 50	38. 45
. 75	121. 5	. 80	54. 01	. 60	38. 19
. 80	117. 7	. 85	53. 66	. 70	37. 94
. 85	114. 2	. 90	53. 32	. 80	37. 70
. 90	111. 0	. 95	52. 98	. 90	37. 46
. 95	108. 0	4. 00	52. 65	8. 00	37. 22
1. 00	105. 3	. 05	52. 32	. 10	36. 99
. 05	102. 7	. 10	52. 00	. 20	36. 77
. 10	100. 4	. 15	51. 69	. 30	36. 55
. 15	98. 20	. 20	51. 38	. 40	36. 33
. 20	96. 12	. 25	51. 07	. 50	36. 11
. 25	94. 18	. 30	50. 78	. 60	35. 90
. 30	92. 36	. 35	50. 48	. 70	35. 70
. 35	90. 63	. 40	50. 20	. 80	35. 49
. 40	88. 99	. 45	49. 91	. 90	35. 29
. 45	87. 45	. 50	49. 63	9. 00	35. 10
. 50	85. 98	. 55	49. 36	. 10	34. 90
. 55	84. 58	. 60	49. 09	. 20	34. 71
. 60	83. 24	. 65	48. 83	. 30	34. 53
. 65	81. 97	. 70	48. 57	. 40	34. 34
. 70	80. 76	. 75	48. 31	. 50	34. 16
. 75	79. 60	. 80	48. 06	. 60	33. 98
. 80	78. 48	. 85	47. 81	. 70	33. 81
. 85	77. 42	. 90	47. 57	. 80	33. 63
. 90	76. 39	. 95	47. 33	. 90	33. 46
. 95	75. 40	5. 00	47. 09	10. 00	33. 29
2. 00	74. 45	. 05	46. 85	. 20	32. 97
. 05	73. 54	. 10	46. 62	. 40	32. 65
. 10	72. 66	. 15	46. 40	. 60	32. 34
. 15	71. 81	. 20	46. 17	. 80	32. 04
. 20	70. 99	. 25	45. 95	11. 00	31. 74
. 25	70. 20	. 30	45. 74	. 20	31. 46
. 30	69. 43	. 35	45. 52	. 40	31. 18
. 35	68. 69	. 40	45. 31	. 60	30. 91
. 40	67. 97	. 45	45. 10	. 80	30. 65
. 45	67. 27	. 50	44. 90	12. 00	30. 39
. 50	66. 59	. 55	44. 69	. 50	29. 78
. 55	65. 94	. 60	44. 49	13. 00	29. 20
. 60	65. 30	. 65	44. 30	. 50	28. 65
. 65	64. 68	. 70	44. 10	14. 00	28. 14
. 70	64. 08	. 75	43. 91	. 50	27. 65
. 75	63. 49	. 80	43. 72	15. 00	27. 18
. 80	62. 92	. 85	43. 53	. 50	26. 74
. 85	62. 37	. 90	43. 35	16. 00	26. 32
. 90	61. 83	. 95	43. 16	. 50	25. 92
. 95	61. 31	6. 00	42. 99	17. 00	25. 53
3. 00	60. 79	. 05	42. 81	. 50	25. 17
. 05	60. 29	. 10	42. 63	18. 00	24. 81
. 10	59. 80	. 20	42. 29	. 50	24. 48
. 15	59. 33	. 30	41. 95	19. 00	24. 15
. 20	58. 86	. 40	41. 62	. 50	23. 84
. 25	58. 41	. 50	41. 30	20. 00	23. 54
. 30	57. 96	. 60	40. 98	. 50	23. 25
. 35	57. 53	. 70	40. 68	21. 00	22. 98
. 40	57. 10	. 80	40. 38	22. 00	22. 45
. 45	56. 69	. 90	40. 08	23. 00	21. 95
. 50	56. 28	7. 00	39. 80	24. 00	21. 49

TABLE 10.—*Sedimentation Time-Diameter Values for Flint at 25° C.*—Continued

TIME	DIAM.	TIME	DIAM.	TIME	DIAM.
(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)	(*Minutes*)	(*Microns*)
25. 00	21. 06	39. 00	16. 86	65. 00	13. 06
26. 00	20. 65	40. 00	16. 64	70. 00	12. 58
27. 00	20. 26	41. 00	16. 44	75. 00	12. 15
28. 00	19. 88	42. 00	16. 24	80. 00	11. 77
29. 00	19. 55	43. 00	16. 05	85. 00	11. 42
30. 00	19. 22	44. 00	15. 87	90. 00	11. 09
31. 00	18. 91	45. 00	15. 69	95. 00	10. 80
32. 00	18. 61	46. 00	15. 52	100. 00	10. 53
33. 00	18. 33	47. 00	15. 35	110. 00	10. 04
34. 00	18. 05	48. 00	15. 19	120. 00	9. 61
35. 00	17. 79	49. 00	15. 04	130. 00	9. 23
36. 00	17. 55	50. 00	14. 89	140. 00	8. 89
37. 00	17. 31	55. 00	14. 19	150. 00	8. 59
38. 00	17. 08	60. 00	13. 59	160. 00	8. 32

7. CERTIFICATION

7.1 In order to assure the purchaser of coated abrasive products that he is getting products which are quality controlled to conform to the grading requirements of this Commercial Standard, producers are urged individually, or in concert with their trade associations, to grade-mark each product complying herewith, by stamp, brand, or label. The following uniform certification statement is recommended for the label;

> The grit size of the abrasive grain on this coated abrasive product complies with all the grading requirements of Commercial Standard CS217–59, as developed by the trade under the procedure of the Commodity Standards Division, and issued by the U.S. Department of Commerce.
>
> _____
>
> Grit size and abrasive — Name of manufacturer

7.1.1 Where space does not permit the use of the full certification statement, the following will suffice:

"Complies with CS 217–59 of the U.S. Department of Commerce"

EFFECTIVE DATE

Having met all procedural requirements of the Commodity Standards Division, including approval by the acceptors hereinafter listed, this Commercial Standard was issued by the U.S. Department of Commerce, effective March 18, 1959.

EDWIN W. ELY,
Chief, Commodity Standards Division

HISTORY OF PROJECT

The cooperation of the Commodity Standards Division in establishing a Commercial Standard for the grading of the abrasive grain used on abrasive coated sheets, belts, discs, rolls and similar products, was requested by the Coated Abrasive Manufacturers' Institute on June 27, 1957. After review by the National Bureau of Standards, a draft submitted by the Institute was modified, and a proposed Commercial Standard was mailed to all manufacturers and to selected users, testing laboratories, and Government agencies on May 5, 1958, for advance comment. Further minor adjustments were made and a Recommended Commercial Standard was widely circulated to producers, distributors, users, and testing laboratories for consideration and final approval on November 26, 1958. Sufficient endorsements in the form of signed acceptances from individual organizations were received to insure the successful application of the new standard. Accordingly, the establishment of Commercial Standard CS217–59, Grading of Abrasive Grain on Coated Abrasive Products, was announced on February 18, 1959, to be effective for new production from March 18, 1959.

Project Manager: William H. Furcolow, Commodity Standards Division, Office of Technical Services, U.S. Department of Commerce.

Technical Advisor: Roman F. Geller, Consultant, Mineral Products Division, National Bureau of Standards, U.S. Department of Commerce.

STANDING COMMITTEE

The function of the Standing Committee is to review, prior to circulation for acceptance, changes proposed to keep the standard abreast of progress. Comments concerning this Standard and suggestions for its revision may be addressed to the Commodity Standards Division, Office of Technical Services, U.S. Department of Commerce, which acts as secretary for the Committee, or to any of its members listed below:

E. W. Bratton, Coated Abrasives Division, The Carborundum Co., Niagara Falls, N.Y. (Chairman).
V. W. Gilbert, Abrasive Division, Behr-Manning Co., Troy, N.Y.
P. D. Balcom, Abrasive Products, Inc., South Braintree, Mass.
Eugene C. Roser, The Abrasive Machine and Supply Co., 261 South St., Newark 5, N.J.
George L. Earle, Jr., North Wayne Tool Co., Oakland, Maine.
William T. Tiffin, College of Engineering, University of Florida, Gainesville, Fla.
John Carroll, Materials Evaluation Department, United States Testing Co., 1415 Park Ave., Hoboken, N.J.

ACCEPTANCE OF COMMERCIAL STANDARD

CS217–59 Grading of Abrasive Grain on Coated Abrasive Products

If acceptance has not previously been filed, this sheet properly filled in, signed, and returned will provide for the recording of your organization as an acceptor of this Commercial Standard.

Date_____

Commodity Standards Division
Office of Technical Services
U.S. Department of Commerce
Washington 25, D.C.

Gentlemen:

We believe that this Commercial Standard constitutes a useful standard of practice, and we individually plan to utilize it as far as practicable in the

production [1] distribution [1] purchase [1] testing [1] of this commodity.

We reserve the right to depart from the standard as we deem advisable.

We understand, of course, that only those articles which actually comply with the standard in all respects can be identified or labeled as conforming thereto.

Signature of authorized officer_____
(In ink)

(Kindly typewrite or print the following lines)

Name and title of above officer_____

Organization_____
(Fill in exactly as it should be listed)

Street address_____

City, zone, and State_____

(Cut on this line)

[1] Underscore the applicable words. Please see that separate acceptances are filed for all subsidiary companies and affiliates which should be listed separately as acceptors. In the case of related interest, trade associations, trade papers, etc., desiring to record their general support, the words "General support" should be added after the signature.

TO THE ACCEPTOR

The following statements answer the usual questions arising in connection with the acceptance and its significance:

1. *Enforcement.*—Commercial Standards are commodity specifications voluntarily established by mutual consent of those concerned. They present a common basis of understanding between the producer, distributor, and consumer and should not be confused with any plan of governmental regulation or control. The United States Department of Commerce has no regulatory power in the enforcement of their provisions, but since they represent the will of the interested groups as a whole, their provisions through usage soon become established as trade customs, and are made effective through incorporation into sales contracts by means of labels, invoices, and the like.

2. *The acceptor's responsibility.*—The purpose of Commercial Standards is to establish, for specific commodities, nationally recognized grades or consumer criteria, and the benefits therefrom will be measurable in direct proportion to their general recognition and actual use. Instances will occur when it may be necessary to deviate from the standard and the signing of an acceptance does not preclude such departures; however, such signature indicates an intention to follow the standard, where practicable, in the production, distribution, or consumption of the article in question.

3. *The Department's responsibility.*—The major function, performed by the Department of Commerce in the voluntary establishment of Commercial Standards on a nationwide basis is fourfold: First, to act as an unbiased coordinator to bring all interested parties together for the mutually satisfactory adjustment of trade standards; second, to supply such assistance and advice as past experience with similar programs may suggest; third, to canvass and record the extent of acceptance and adherence to the standard on the part of producers, distributors, and users; and fourth, after acceptance, to publish and promulgate the standard for the information and guidance of buyers and sellers of the commodity.

4. *Announcement and promulgation.*—When the standard has been endorsed by a satisfactory majority of production or consumption in the absence of active, valid opposition, the success of the project is announced. If, however, in the opinion of the standing committee or of the Department of Commerce, the support of any standard is inadequate, the right is reserved to withhold promulgation and publication.

ACCEPTORS

The organizations listed below have individually accepted this standard for use as far as practicable in the production, distribution, purchase, or use of coated abrasive products. In accepting this standard they reserved the right to depart from it as they individually deem advisable. It is expected that products which actually comply with the requirements of this standard in all respects will be regularly identified or labeled as conforming thereto, and that purchasers will require such specific evidence of conformity.

ASSOCIATIONS

(General Support)

Coated Abrasives Manufacturers' Institute, New York, N.Y.

FIRMS

Abrasive Machine and Supply Co., Newark, N.J.
Abrasive Products Co., Lansdowne, Pa.
Abrasive Products, Inc., South Braintree, Mass.
Allen and Jemison Co., Tuscaloosa, Ala.
Amarillo Hardware Co., Amarillo, Tex.
American Abrasive Co., Westfield, Mass.
American Graded Sand Co., Chicago, Ill.
American Standards Testing Bureau, Inc., New York, N.Y.
Anderson Machine Tool Co., St. Paul, Minn.
Armour and Company, Alliance, Ohio
Atlas Abrasives Corp., Brooklyn, N.Y.

Barton Mines Corp., North Creek, N.Y.
Bates Products, Inc., Chicago, Ill.
Bay State Abrasive Products Co., Westboro, Mass. (General Support).
Behr-Manning Co., Troy, N.Y.
Bowser-Morner Testing Laboratories, Inc., Dayton, Ohio.
Bragg, N. H., and Sons, Bangor, Maine
Bruce Williams Laboratories, Joplin, Mo.

Carborundum Co., Coated Abrasives Division, Niagara Falls, N.Y.
Carborundum Co., Electro Minerals Division, Niagara Falls, N.Y.
Carlisle Hardware Co., Springfield, Mass.
Clover Manufacturing Co., Norwalk, Conn.
Crippen and Erlich Laboratories, Inc., Baltimore, Md.

Danser Hardware and Supply Co., Weston, W. Va.

Exolon Co., Tonawanda, N.Y.

Froehling and Robertson, Inc., Richmond, Va.

General Abrasive Co., Inc., Niagara Falls, N.Y.

Hamilton Emery and Corundum Co., Chester, Mass.

Herron Testing Laboratories, Inc., Cleveland, Ohio.
Hunt, Robert W., Co., Chicago, Ill.

Indiana Manufacturers Supply Co., Indianapolis, Ind.

Jensen-Byrd Co., Spokane, Wash.

Kluyskens, Co., Gerard, New York, N.Y.

Marine Specialty and Mill Supply Co., Inc., New Orleans, La.
Michigan Abrasive Co., Detroit, Mich.
Mid-West Abrasive Co., Owosso, Mich.
Minnesota Mining and Manufacturing Co., Coated Abrasives and Related Products Division, St. Paul, Minn.
Munning and Munning, Inc., Newark, N. J.

North Wayne Tool Co., Oakland, Maine
Norton Co., Worcester, Mass.

Pratt-Gilbert Hardware Co., Phoenix, Ariz.
Pullman Co., Chicago, Ill.

Sandpaper, Inc., Rockland, Mass.
Scientific Abrasives, Highland Park, Ill.
Sears, Roebuck and Co., Chicago, Ill.
Simonds Abrasive Co., Philadelphia, Pa.

Tennessee Sandpaper Corp., Nashville, Tenn.

United States Testing Co., Inc., Hoboken, N.J.
Univ. of Fla., Mechanical Engineering Dept., Gainesville, Fla.

Van Camp Hardware and Iron Co., Inc., Indianapolis, Ind.

Washington Mills Abrasive Co., North Grafton, Mass.
Wilson Chemical and Testing Laboratory, El Paso, Tex.

U.S. GOVERNMENT

Bureau of Ships, Navy Department, Washington, D.C.
Department of the Army, Washington, D.C.

Other Commercial Standards

A list of all Commercial Standards may be obtained from the Commodity Standards Division, Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. This list includes the purchase price of each publication and gives directions for ordering copies.

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